IAEA SAFEGUARDS GLOSSARY

2022 Edition

IAEA
International Atomic Energy Agency
Atoms for Peace and Development

IAEA SAFEGUARDS GLOSSARY

2022 EDITION

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The Agency's Statute was approved on 23 October 1956 by the Conference on the Statute of the IAEA held at United Nations Headquarters, New York; it entered into force on 29 July 1957. The Headquarters of the Agency are situated in Vienna. Its principal objective is "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world".

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FOREWORD

The year 2022 features the anniversaries of several milestones in IAEA safeguards: 60 years since the IAEA conducted its first in-field inspection; 50 years since the first comprehensive safeguards agreements were concluded in connection with the Treaty on the Non-Proliferation of Nuclear Weapons; and 25 years since the approval by the IAEA Board of Governors of the Model Additional Protocol. This anniversary update of the IAEA Safeguards Glossary reflects the continuing evolution of safeguards to address new challenges and technologies in an ever-expanding nuclear field.

The IAEA published the first IAEA Safeguards Glossary (IAEA/SG/INF/1) in 1980, with the aim of facilitating understanding of the specialized safeguards terminology within the international community. The IAEA Safeguards Glossary was revised in 1987 (IAEA/SG/INF/1 (Rev.1)) and again in 2001 (IAEA/NVS/3) to reflect, among other things, developments associated with the Model Additional Protocol, such as the advent of integrated safeguards and the implementation of customized safeguards approaches for States (known as State-level safeguards approaches, or SLAs).

Since then, IAEA safeguards implementation has continued to evolve, including greater emphasis on 'State as a whole' considerations in the implementation of safeguards, and to reflect numerous technological advancements. The 2022 Edition of the IAEA Safeguards Glossary reflects these developments, as well as the natural evolution and elaboration of terminology acquired over twenty additional years of experience in safeguards implementation.

The IAEA Safeguards Glossary does not represent a comprehensive collection of all terms used in IAEA safeguards but rather collects those terms that are unique to IAEA safeguards or that may be used in other domains but have a specific meaning or application relevant to IAEA safeguards. In this edition, terms deemed to not meet these criteria have been removed and new terms that have come into use in the past two decades have been introduced.

Each section of the IAEA Safeguards Glossary addresses a specific subject area relevant to IAEA safeguards. To facilitate understanding, each term includes a definition and, where applicable, further explanation or examples. The sequence of terms within a section corresponds to the internal relationships of the subject area. A new section covering 'State and Regional Authorities, Responsibilities, Support and Services' has been introduced, reflecting an increased emphasis on State cooperation and support with the evolution of the global nuclear industry since the 2001 Edition.

The terms are numbered consecutively within each section; an index referring to these numbers has been provided for ease of reference. Within each definition, terms that are defined elsewhere in the IAEA Safeguards Glossary are italicized. Numbers or abbreviations in square backets refer to the IAEA documents and publications noted at the beginning of this publication. The terms have been translated into the official languages of the IAEA, as well as into German and Japanese.

The IAEA Safeguards Glossary has no legal status and is not intended to serve as a basis for adjudicating on problems of definition such as might arise during the negotiation or in the interpretation of safeguards agreements or protocols thereto.

The IAEA wishes to acknowledge the many individuals who contributed to this publication. The IAEA officer responsible for this publication was J. Martinez of the Division of Concepts and Planning.

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CONTENTS

1. LEGAL INSTRUMENTS AND OTHER DOCUMENTS RELATED TO IAEA SAFEGUARDS

Safeguards applied by the International Atomic Energy Agency (IAEA) are an important element of the global nuclear non-proliferation regime. This section provides information on legal instruments and other documents in the area of nuclear non-proliferation that either provide a legal basis for IAEA safeguards or are otherwise closely linked to the application of IAEA safeguards. These include the Statute of the IAEA, treaties requiring verification of nuclear non-proliferation undertakings, other relevant treaties, the basic safeguards documents, safeguards agreements and their relevant protocols, and guidelines related to the implementation of IAEA safeguards.

1.1. Statute of the International Atomic Energy Agency. The *Statute of the IAEA* was approved on 23 October 1956 by the Conference on the Statute of the IAEA and entered into force on 29 July 1957. The *Statute* has been amended three times: in 1963, 1973 and 1989. According to Article II, the IAEA shall:

> "seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world. It shall ensure, so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose."

Article III.A.5 authorizes the IAEA to:

> "establish and administer safeguards designed to ensure that special fissionable and other materials, services, equipment, facilities, and information made available by the Agency or at its request or under its supervision or control are not used in such a way as to further any military purpose; and to apply safeguards, at the request of the parties, to any bilateral or multilateral arrangement, or at the request of a State, to any of that State's activities in the field of atomic energy".

In carrying out these functions, the IAEA may conclude agreements with the parties concerned which provide for the application of *IAEA safeguards* or may implement other verification activities when approved by the IAEA Board of Governors in accordance with its authority provided for in Article VI.F. Article XII.A refers to the rights and responsibilities of the IAEA to the extent relevant to any project or arrangement where the IAEA is requested to apply safeguards. Article XII.C refers, inter alia, to actions which may be taken by the Board in possible cases of *non-compliance* with *safeguards agreements*.

TREATIES AND SUPPLY AGREEMENTS

1.2. Treaty on the Non-Proliferation of Nuclear Weapons (or Non-Proliferation Treaty) (NPT). The *NPT* is the cornerstone of the international nuclear non-proliferation regime. The Treaty was opened for signature on 1 July 1968 and entered into force on 5 March 1970. In 1995, the Treaty was extended indefinitely. Pursuant to Article I, each nuclear-weapon State (NWS) party undertakes not to transfer to any recipient whatsoever nuclear weapons or other nuclear explosive devices or control over such weapons or explosive devices directly or indirectly, and not in any way to assist, encourage or induce any non-nuclear-weapon State (NNWS) to manufacture or otherwise acquire such weapons or explosive devices, or control over such weapons or explosive devices.

Pursuant to Article II, each NNWS party undertakes not to receive the transfer from any transferor whatsoever of nuclear weapons or other nuclear explosive devices or of control over such weapons or explosive devices directly or indirectly, not to manufacture or otherwise acquire such weapons or explosive devices and not to seek or receive any assistance in the manufacture of such weapons or explosive devices.

Pursuant to Article III.1, each NNWS party undertakes to accept safeguards, as set forth in an agreement to be negotiated and concluded with the IAEA in accordance with the *Statute of the IAEA* and the *IAEA safeguards system*, for the exclusive purpose of verification of the fulfilment of the State's obligations under the *NPT* with a view to preventing diversion of nuclear energy from peaceful purposes to nuclear weapons or other nuclear explosive devices. Article III.1 further provides that these safeguards shall be applied on all *source material* or *special fissionable material* in all peaceful nuclear activities within the territory of such State, under its jurisdiction or carried out under its control anywhere. Pursuant to Article III.2, each State party to the *NPT* undertakes not to provide *source material* or *special fissionable material*, or equipment or material especially designed or prepared for the processing, use or production of *special fissionable material*, to any NNWS for peaceful purposes, unless the *source material* or *special fissionable material* is subject to the safeguards required by Article III.1.

Article IV.1 provides that nothing in the Treaty shall be interpreted as affecting the inalienable right of all parties to the *NPT* to develop research, production and use of nuclear energy for peaceful purposes without discrimination and in accordance with Articles I and II of the Treaty. Under Article IV.2, all parties undertake to facilitate, and have the right to participate in, the fullest possible exchange of equipment, materials and scientific and technical information for the peaceful uses of nuclear energy.

Pursuant to Article VI, each party undertakes to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control. Article IX.3 defines a NWS as one which manufactured and exploded a nuclear weapon or other nuclear explosive device prior to 1 January 1967. There are five NWS parties to the *NPT*: China, France, the Russian Federation (the Soviet Union when the Treaty entered into force), the United Kingdom and the United States of America. The text of the Treaty is reproduced in [140].

1.3. Treaty for the Prohibition of Nuclear Weapons in Latin America and the Caribbean (Tlatelolco Treaty). The Treaty established the first regional nuclear-weapon-free zone requiring Contracting Parties to accept the application of *IAEA safeguards*. The Treaty was opened for signature on 14 February 1967 and entered into force for each Government individually. The Treaty prohibits the testing, use, manufacture and production or acquisition by any means whatsoever of any nuclear weapons, as well as the receipt, storage, installation, deployment and any form of possession of any nuclear weapons by States, directly or indirectly, in the geographical zone of application of the Treaty. Pursuant to Article 13 of the Treaty, each party undertakes to conclude multilateral or bilateral agreements with the IAEA for the application of *IAEA safeguards* to its nuclear activities.

Under Additional Protocol I to the Treaty, States outside the geographical zone which have de jure or de facto jurisdiction over territories within the limits of the zone undertake to apply to those territories the statute of denuclearization in respect of warlike purposes as defined in the Treaty.

Under Additional Protocol II to the Treaty, each of the nuclear-weapon States as defined by the *Treaty on the Non-Proliferation of Nuclear Weapons (NPT)* undertakes to respect the statute of denuclearization in the region and not to use or threaten to use nuclear weapons against the parties to the Treaty. The text of the *Tlatelolco Treaty* is reproduced in [179], with amendments published in [411].

1.4. South Pacific Nuclear Free Zone Treaty (Rarotonga Treaty). The Treaty established a nuclear-weapon-free zone in the South Pacific region. It entered into force on 11 December 1986. Each party undertakes not to manufacture or otherwise acquire, possess or have control over any nuclear explosive device by any means anywhere inside or outside the South Pacific Nuclear Free Zone, not to seek or receive any assistance in the manufacture or acquisition of any nuclear explosive device and not to take any action to assist or encourage the manufacture or acquisition of any nuclear explosive device by any State. State parties also undertake to prevent the stationing or testing of any such devices anywhere within the South Pacific Nuclear Free Zone. Each State party to the Treaty undertakes to accept safeguards as provided for in a *comprehensive safeguards agreement (CSA)* with the IAEA required in connection with the *Treaty on the Non-Proliferation of Nuclear Weapons (NPT)*, or an agreement equivalent in its scope and effect to such an agreement, and not to provide *source material* or *special fissionable material*, or equipment or material especially designed or prepared for the processing, use or production of *special fissionable material* for peaceful purposes to any non-nuclear-weapon State unless subject to the safeguards required by Article III.1 of the *NPT*, or to any nuclear-weapon State unless subject to applicable *safeguards agreements* with the IAEA. The *Rarotonga Treaty* has three protocols: Protocols 1 and 2 contain provisions similar to those in the two protocols to the *Treaty for the Prohibition of Nuclear Weapons in Latin America and the Caribbean (Tlatelolco Treaty)*, and Protocol 3 requires each party not to test any nuclear explosive device anywhere within the South Pacific Nuclear Free Zone. The text of the Treaty is reproduced in [331].

1.5. Treaty on the Southeast Asia Nuclear Weapon-Free Zone (Bangkok Treaty). The Treaty established a nuclear-weapon-free zone in the Southeast Asia region. It was opened for signature on 15 December 1995 and entered into force 27 March 1997. The Treaty requires its parties, inter alia, not to develop, manufacture or otherwise acquire, possess or have control over, station, transport, test or use nuclear weapons anywhere, and not to allow in their respective territories any other State to develop, acquire, possess, control, station, test or use such weapons. Each State party to the Treaty undertakes to have in force an agreement with the IAEA for the application of 'full scope' (comprehensive) safeguards to its peaceful nuclear activities and not to provide *source material* or *special fissionable material*, or equipment or material especially designed or prepared for the processing, use or production of *special fissionable material*, to any non-nuclear-weapon State except under conditions subject to the safeguards required by Article III.1 of the *Treaty on the Non-Proliferation of Nuclear Weapons (NPT)*, or to any nuclear-weapon State except in conformity with applicable *safeguards agreements* with the IAEA. The Annex to the *Bangkok Treaty* provides for fact-finding missions to State parties in order to clarify and resolve a situation which may be considered ambiguous or which may give rise to doubts about compliance with the provisions of the Treaty; the Annex outlines the relevant procedures, including provision for the involvement of *IAEA inspectors* in any such mission. A protocol to the Treaty contains provisions similar to those in Additional Protocol II to the *Treaty for the Prohibition of Nuclear Weapons in Latin America and the Caribbean (Tlatelolco Treaty)*. The text of the *Bangkok Treaty* is reproduced in [548].

1.6. African Nuclear-Weapon-Free Zone Treaty (Pelindaba Treaty).[1] The Treaty established a nuclear-weapon-free zone in Africa. It was opened for signature on 11 April 1996 and entered into force on 15 July 2009. The Treaty requires its parties, inter alia, not to conduct research on, develop, manufacture, stockpile or otherwise acquire, possess or have control over any nuclear explosive device by any means anywhere, and to prohibit the stationing or testing of any such device in their territory. Each State party to the Treaty is required to declare any capability for the manufacture of nuclear explosive devices; to dismantle and destroy any such device that it had manufactured prior to the coming into force of the Treaty; and to destroy or convert to peaceful uses the manufacturing facilities, subject to the IAEA's verification of the dismantling, destruction or conversion. Each State party to the Treaty undertakes to have in force a *comprehensive safeguards agreement (CSA)* with the IAEA required in connection with the *Treaty on the Non-Proliferation of Nuclear Weapons (NPT)*, or an agreement equivalent in scope and effect to such an agreement, and not to provide *source material* or *special fissionable material*, or equipment or material especially designed or prepared for the processing, use or production of *special fissionable material* for peaceful purposes to any non-nuclear-weapon State unless subject to a *CSA* with the IAEA. The *Pelindaba Treaty* provides a procedure for a State party to bring complaints against other parties, which could lead to a request for additional IAEA *inspections*. There are three protocols to the *Pelindaba Treaty*: Protocols I and III contain provisions similar to those in the two additional protocols to the *Treaty for the Prohibition of Nuclear Weapons in Latin America and the Caribbean (Tlatelolco Treaty)*, and Protocol II contains provisions similar to those in Protocol 3 to the *South Pacific Nuclear Free Zone Treaty (Rarotonga Treaty)*.

1.7. Treaty on a Nuclear-Weapon-Free Zone in Central Asia (Semipalatinsk Treaty).[2] The Treaty established the nuclear-weapon-free zone in Central Asia (CANWFZ). It was opened for signature on 8 September 2006 and entered into force on 21 March 2009. The Treaty requires its parties, inter alia, not to conduct

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[1] Final text of the African Nuclear-Weapon-Free Zone Treaty (the Pelindaba Treaty), United Nations General Assembly resolution A/RES/50/78, UN, New York (1996).

[2] Treaty on a Nuclear-Weapon-Free Zone in Central Asia, UN Treaty Series Vol. 2970, No. I-51633 (2014).

research on, develop, manufacture, stockpile or otherwise acquire, possess or have control over any nuclear weapon or other nuclear explosive device by any means anywhere, or to receive assistance or take any action to assist or encourage the conduct of these activities. State parties also undertake not to allow in their territory the production, acquisition, stationing, storage or use of any nuclear weapon or nuclear explosive device and not to allow the disposal in their territory of radioactive *waste* of other States. Parties are required to have in force with the IAEA both a *comprehensive safeguards agreement (CSA)* and an *additional protocol (AP)* and undertake not to provide *source material* or *special fissionable material*, or equipment or material especially designed or prepared for the processing, use or production of special fissile material, to any non-nuclear-weapon State unless that State has concluded a *CSA* and an *AP* with the IAEA. Under the Protocol to the Treaty, nuclear-weapon States undertake not to use or threaten to use a nuclear weapon or other nuclear explosive device against any party to the Treaty.

1.8. Agreement Between the Republic of Argentina and the Federative Republic of Brazil for the Exclusively Peaceful Use of Nuclear Energy. Under the Agreement both States parties undertake (a) to prohibit and prevent in their territories and to abstain from carrying out, promoting or participating in, the testing, use, manufacture or acquisition of any nuclear weapon or other nuclear explosive device and (b) to establish the Common System of Accounting and Control of Nuclear Materials (SCCC) and the *Brazilian–Argentine Agency for Accounting and Control of Nuclear Materials (ABACC)* to verify, inter alia, that the *nuclear materials* in all nuclear activities of the parties are not diverted to the purposes prohibited by the Agreement. This Agreement was signed and entered into force in 1991; it is reproduced in [395].

1.9. Treaty Establishing the European Atomic Energy Community (Euratom Treaty). The Treaty was signed by the six original signatories in Rome on 25 March 1957 and entered into force on 1 January 1958. It established a common nuclear market among its State parties and provides that special fissile materials shall be the property of the Community. The Treaty also established the Euratom Supply Agency (ESA), which has the exclusive right to conclude contracts for the supply of ores, *source materials* and special fissile materials within the European Union. In accordance with Article 77, Chapter VII of Title II of the Treaty, the Commission of the European Atomic Energy Community will satisfy itself that, in the territories of Member States, (a) ores, *source materials* and special fissile materials are not diverted from their intended uses as declared by the users and (b) the provisions relating to supply and any particular safeguarding obligations assumed by the Community under an agreement concluded with a third State or an international organization are complied with.

1.10. Bilateral cooperation agreement. An agreement providing for cooperation in the field of peaceful uses of nuclear energy which is usually concluded between a supplier State and a receiver State and which covers conditions for the supply of *nuclear material* and other specified material, equipment and technology. Such an agreement may contain undertakings not to use the supplied items so as to further any military purpose or for the manufacture of nuclear weapons or other nuclear explosive devices. The agreement may also contain undertakings of the receiver State to submit to *IAEA safeguards* a range of facilities, equipment and *nuclear material* and non-nuclear material, as identified in each individual case.

1.11. Project and supply agreement. Article III.A.5 of the *Statute of the IAEA* envisions the application of *IAEA safeguards* to assistance provided by or through the IAEA. Article XI.F.4 requires that, upon approving a project, the IAEA shall enter into an agreement with the member or group of members submitting the project. The agreement shall include undertakings that the assistance provided shall not be used in such a way as to further any military purpose and that the project shall be subject to the safeguards provided for in Article XII, the relevant safeguards being specified in the agreement. A *project and supply agreement* with a State that has a *comprehensive safeguards agreement (CSA)* in force generally provides that the safeguards requirements of the *project and supply agreement* shall be met by the application of safeguards pursuant to the *CSA*. A *project and supply agreement* with a State that does not have a *CSA* in force normally provides for the application of safeguards based on [66].

1.12. The Application of Safeguards in Relation to the Granting of Technical Assistance. The provisions established by the IAEA Board of Governors on 24 September 1977 for the application of safeguards in relation to the granting of technical assistance, reproduced in the Annex to the Revised Guiding Principles and General Operating Rules to Govern the Provision of Technical Assistance by the Agency [267]. The guiding principles governing the provision of technical assistance by the IAEA provide that *IAEA safeguards* shall be applied to all forms of technical assistance in all sensitive technological areas as set forth in the Annex or as subsequently amended by the Board. In the case of IAEA Member States which have concluded appropriate *safeguards agreements* with the IAEA concerning the relevant activity, no additional *safeguards agreements* relating to the benefits obtained from technical assistance provided by the IAEA are required. In the case of Member States for which such provisions do not apply, *safeguards agreements*, where applicable, are required to be drawn up by the

IAEA to cover materials and facilities utilizing the technology being transferred and are to be concluded before the delivery of the technical assistance. In the case of requests for scientific visits and fellowships no safeguards will normally be required. However, when, in the opinion of the IAEA Secretariat, the quantum of assistance granted through such means constitutes a "substantial contribution" to a project in a "sensitive technological area" within a requesting Member State, the matter will be brought to the attention of the Board for appropriate action.

1.13. Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the IAEA. An agreement concluded between the IAEA and a State, as required by the guiding principles governing the provision of technical assistance by the IAEA to a Member State reproduced in [267]. Under a revised supplementary agreement, a State undertakes that the technical assistance it receives pursuant to the agreement shall be used only for peaceful applications of atomic energy and, in particular, that such assistance shall not be used for the manufacture of nuclear weapons, for the furtherance of any military purpose or for uses which could contribute to the proliferation of nuclear weapons, such as research on or development, testing or manufacture of a nuclear explosive device. To this end, the agreement further provides that the IAEA's rights and responsibilities provided for in Article XII.A of the *Statute of the IAEA* shall be implemented and maintained with respect to a project subject to the agreement pursuant to an applicable *safeguards agreement* which is in force between a government and the IAEA or, in the absence of such an agreement, pursuant to a *safeguards agreement* to be concluded between a government and the IAEA prior to the implementation of the assistance approved for the project.

BASIC SAFEGUARDS DOCUMENTS

1.14. The Agency's Inspectors (the Inspectors Document). The Annex to [39], referred to in *item-specific safeguards agreements* as the Inspectors Document, contains detailed provisions relating to *IAEA inspectors* which were considered by the IAEA Board of Governors to be in effect as from 29 June 1961. The document addresses aspects of *inspection activities*, including the procedure by which *IAEA inspectors* are to be designated to a State; the method of announcing and carrying out *inspections* and *visits*; the conduct of *inspections*, rights of access, inspection procedures and the obligation to report to the State on the results of each *inspection*; and the privileges and immunities of *IAEA inspectors*. The provisions of this document acquire legally binding force only when and to the extent that they are incorporated, by reference or otherwise, into *safeguards agreements*. The document in itself does not constitute an agreement.

1.15. The Agency's Safeguards (1961, extended in 1964). The document containing the provisions of the IAEA's 'safeguards system' was approved by the IAEA Board of Governors on 31 January 1961, including the principles and procedures for the information and guidance of Member States and for the Board itself in the administration of safeguards by the IAEA [26]. The safeguards procedures in the document cover requirements anticipated by the IAEA at that time and related only to reactors with less than 100 MW(th) output, to the *source material* and *special fissionable material* used and produced in these reactors, and to small research and development facilities. On 26 February 1964, the Board approved provisions to "extend the Agency's safeguards system" outlined in [26] to make it relate to reactors of 100 MW(th) or more (Add.1). The provisions of this document acquire legally binding force only when and to the extent that they are incorporated, by reference or otherwise, into *safeguards agreements*.

1.16. The Agency's Safeguards System (1965, as Provisionally Extended in 1966 and 1968). The document, also known as the 'Safeguards Document', was designed to facilitate and standardize as far as possible the content of *safeguards agreements* with the IAEA [66]. Approved by the IAEA Board of Governors initially in 1965, the document covered reactors of all sizes, thereby replacing [26], which covered only reactors with less than 100 MW(th) output. It was subsequently extended in 1966 and 1968 to cover *reprocessing plants*, and *conversion plants* and *fuel fabrication plants* (Rev.1 and Rev.2, respectively). The provisions of this document acquire legally binding force only when and to the extent that they are incorporated, by reference or otherwise, into *safeguards agreements*, also known as '*item-specific safeguards agreements*' or 'INFCIRC/66-type' safeguards agreements.

1.17. The Structure and Content of Agreements Between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons. The document provides the structure and content of agreements for the application of *IAEA safeguards* on all *nuclear material* in all peaceful nuclear activities in a State [153]. Approved by the IAEA Board of Governors on 20 April 1971, it serves as the basis for the negotiation of *comprehensive safeguards agreements (CSAs)* between the IAEA and non-nuclear-weapon States party to the *Treaty on the Non-Proliferation of Nuclear Weapons (NPT)*, as well as for negotiation of other *CSAs* concluded pursuant to nuclear-weapon-free zone treaties. The document also provides the framework for the *voluntary offer agreements (VOAs)* which the five *NPT* nuclear-weapon States have concluded with the IAEA.

1.18. Model Protocol Additional to the Agreement(s) Between State(s) and the International Atomic Energy Agency for the Application of Safeguards. The document [540], also known as the '*Model Additional Protocol*', provides for those measures for strengthening the effectiveness and improving the efficiency of *IAEA safeguards* which require complementary legal authority. It was approved by the IAEA Board of Governors on 15 May 1997. The IAEA uses the *Model Additional Protocol* for the negotiation and conclusion of *additional protocols (APs)* and other legally binding agreements as follows:

(a) With States and other parties to *comprehensive safeguards agreements (CSAs)*, containing all of the measures provided for in [540];
(b) With nuclear-weapon States, incorporating those measures from [540] that each such State has identified as capable of contributing to the non-proliferation and efficiency aims of the *Model Additional Protocol* when implemented with regard to that State, and as consistent with that State's obligations under Article I of the *Treaty on the Non-Proliferation of Nuclear Weapons (NPT)*;
(c) With other States that are prepared to accept measures provided for in [540] in pursuance of safeguards effectiveness and efficiency objectives.

1.19. Agreement on the Privileges and Immunities of the International Atomic Energy Agency. The Agreement, reproduced in [9], grants, inter alia, certain privileges and immunities to the IAEA and its property, representatives of Member States and IAEA officials, including *IAEA inspectors*, as necessary for the effective exercise of their functions. The Agreement also provides for the recognition and acceptance of the United Nations laissez-passer issued to IAEA officials as a valid travel document. *Safeguards agreements* concluded with States which are not IAEA Member States or which are not party to the Agreement provide for the granting to *IAEA inspectors* of the same privileges and immunities as those specified in the Agreement.

SAFEGUARDS AGREEMENTS, ADDITIONAL PROTOCOLS THERETO AND UNDERTAKINGS RELATED TO SAFEGUARDS IMPLEMENTATION

1.20. Safeguards agreement. An agreement for the application of safeguards concluded between the IAEA and a State or a group of States, in some cases together with a *regional authority responsible for safeguards implementation*, such as the *European Atomic Energy Community (Euratom*) and the *Brazilian–Argentine Agency for Accounting and Control of Nuclear Materials*

(ABACC). Such an agreement is concluded either because of the requirements of a *project and supply agreement*, or to satisfy the relevant requirements of bilateral or multilateral arrangements, or to apply safeguards at the request of a State to any of that State's nuclear activities.

1.21. INFCIRC/153-type safeguards agreement. An agreement concluded on the basis of [153], including *comprehensive safeguards agreements (CSAs)* and *voluntary offer agreements (VOAs)*.

1.22. Comprehensive safeguards agreement (CSA). An agreement concluded pursuant to the *Treaty on the Non-Proliferation of Nuclear Weapons (NPT)* and/or a nuclear-weapon-free zone (NWFZ) treaty under which a State undertakes to accept, and the IAEA has the right and obligation to apply, safeguards on all *source material* or *special fissionable material* in all peaceful nuclear activities within the State's territory, under its jurisdiction or carried out under its control anywhere, for the exclusive purpose of verifying that such material is not diverted to nuclear weapons or other nuclear explosive devices. Since 1972, *CSAs* in connection with the *NPT* and/or NWFZ treaties have been concluded on the basis of [153]. *CSAs* are also referred to as 'full scope' *safeguards agreements*.

Some *CSAs*, such as the sui generis agreement between Albania and the IAEA, and the quadripartite *safeguards agreement* between Argentina, Brazil, the *Brazilian–Argentine Agency for Accounting and Control of Nuclear Materials (ABACC)* and the IAEA, were concluded prior to Albania's accession to the *NPT* and the accession of Argentina and Brazil to the *NPT* and the *Treaty for the Prohibition of Nuclear Weapons in Latin America and the Caribbean (Tlatelolco Treaty)*. The IAEA Board of Governors approved exchanges of letters with the States concerned confirming that such agreements also meet their obligations under the *NPT* (Albania) and the *NPT* and the *Tlatelolco Treaty* (Argentina and Brazil).

1.23. Item-specific safeguards agreement. An agreement based on [66] or [26]. Such an agreement specifies the items (e.g. *nuclear material*, non-nuclear material such as heavy water), *facilities* and/or equipment to be safeguarded and prohibits the use of the specified items in such a way as to further any military purpose. Since 1975, such agreements also explicitly proscribe any use related to the manufacture of any nuclear weapon or other nuclear explosive device. *Item-specific safeguards agreements* can be grouped as follows:

(a) An agreement concluded pursuant to a *project and supply agreement* between the IAEA and a State that does not have a *comprehensive safeguards agreement (CSA)* providing for the supply by or through the IAEA of *nuclear* *material*, services, equipment, *facilities* and/or information to the State and, in that connection, for the application of *IAEA safeguards*.

(b) A *safeguards agreement* between the IAEA and one or more States providing for the application of safeguards to *nuclear material*, services, equipment or *facilities* supplied under a cooperation arrangement between States, or, having been subject to such safeguards, retransferred to States without *CSAs*. Some *bilateral cooperation agreements* concluded before *IAEA safeguards* were operational provided for safeguards to be applied by the supplier State; the parties to those agreements later requested the IAEA to apply its safeguards instead. A *safeguards agreement* transferring the safeguards responsibility to the IAEA, typically concluded between the IAEA and both the supplier and recipient States, came to be known as a safeguards transfer agreement (STA).

(c) A unilateral submission agreement between the IAEA and a State, concluded at the request of that State, for the application of safeguards to any of the State's activities in the field of nuclear energy.

1.24. Voluntary offer agreement (VOA). An agreement concluded between the IAEA and a nuclear-weapon State as defined in the *Treaty on the Non-Proliferation of Nuclear Weapons (NPT)* which is not required to accept *IAEA safeguards* under the *NPT* but has voluntarily offered to do so, inter alia, to allay concerns that the application of *IAEA safeguards* could lead to commercial disadvantages for the nuclear industries of non-nuclear-weapon States. Under such an agreement, a State offers, for selection by the IAEA for the application of safeguards, some or all of the *nuclear material* and/or *facilities* in its civil *nuclear fuel cycle*. A *VOA* generally follows the structure of [153], but the scope is limited to *nuclear material* and *facilities* in civilian activities offered by the State for the application of *IAEA safeguards*. The IAEA has concluded such a *VOA* with each of the five *NPT* nuclear-weapon States (i.e. China, France, the Russian Federation, the United Kingdom and the United States of America).

1.25. Additional protocol (AP). A protocol additional to a *safeguards agreement* (or agreements) concluded between the IAEA and a State, or group of States, following the provisions of the *Model Additional Protocol* [540]. In the case of a State with a *comprehensive safeguards agreement (CSA)*, the *AP* must contain all of the measures included in [540]. In the case of an *item-specific safeguards agreement* or a *voluntary offer agreement (VOA)*, an *AP* includes those measures from [540] that have been accepted by the State. Under Article 1 of [540], the provisions of the *AP* prevail in the case of conflict between the provisions of the *safeguards agreement* and those of the *AP*.

1.26. Original small quantities protocol (original SQP). A protocol to a *comprehensive safeguards agreement (CSA)* concluded between the IAEA and a State based on the text contained in Annex B to [276], published in 1974. The *original SQP* holds in abeyance the implementation of most of the safeguards procedures in Part II of a *CSA* as long as the eligibility criteria are met by the State. The eligibility criteria for an SQP based on the original standard text are that the State has *nuclear material* in amounts less than those specified in para. 37 of [153] and no *nuclear material* in a *facility* as defined in [153]. States with *original SQPs* are required to provide to the IAEA an annual report on *imports and exports* of *nuclear material* and *design information* before introducing *nuclear material* into a *facility*. They are not required to provide to the IAEA an *initial report* on all *nuclear material* subject to safeguards or early *design information*, nor are they required to accept designation of *IAEA inspectors* or to allow the IAEA *access for inspections*. The IAEA Board of Governors recognized on 20 September 2005 that the *SQP* based on the original standard text constituted a weakness in the *IAEA safeguards system* and that, although SQPs should remain part of the *IAEA safeguards system*, they should be subject to the modifications specified in [276/1].

1.27. Revised small quantities protocol (revised SQP). A protocol to a *comprehensive safeguards agreement (CSA)* concluded between the IAEA and a State based on the revised standard text approved by the IAEA Board of Governors on 20 September 2005. The *revised SQP* standard text is contained in Annex B to [276/1]. The *revised SQP* reduces the number of provisions in Part II of the *CSA* the implementation of which is held in abeyance as long as the State meets the eligibility criteria. The eligibility criteria for an SQP based on the revised standard text are that the State has *nuclear material* in amounts less than those specified in para. 37 of [153] and no decision has been taken by the State to construct or authorize construction of a *facility* as defined in [153]. An SQP based on the revised standard text is unavailable to a State with a planned or existing *facility*. States with *revised SQPs* are required to provide to the IAEA an *initial report* on all *nuclear material* subject to *IAEA safeguards*, an annual report on *imports and exports* of *nuclear material*, and early *design information*; to accept the designation of *IAEA inspectors*; and to allow *access for inspections*.

1.28. Suspension protocol. A protocol to a *safeguards agreement* with a State (or States) which suspends the application of safeguards under that agreement while, and to the extent that, *IAEA safeguards* are being applied for the State (or States) under another *safeguards agreement* (or agreements) concluded subsequently. Examples include protocols to suspend the application of safeguards under *project and supply agreements* or under safeguards transfer agreements for States where *comprehensive safeguards agreements (CSAs)* have come into force.

1.29. Cooperation protocol. A protocol amplifying the provisions of a *safeguards agreement* between the IAEA and a State or a group of States, in some cases together with a *regional authority responsible for safeguards implementation*, specifying the conditions and means of the cooperation in the application of *IAEA safeguards* provided for in the agreement (e.g. arrangements to coordinate *inspection activities* of the IAEA and the parties to the agreement). Such cooperation protocols have been incorporated into the agreements for the application of safeguards between the IAEA and Argentina, Brazil and the *Brazilian–Argentine Agency for Accounting and Control of Nuclear Materials (ABACC)*; the IAEA and Japan; the IAEA and the non-nuclear-weapon States of the *European Atomic Energy Community (Euratom)* and *Euratom*; and the IAEA, France and *Euratom*.

1.30. Subsidiary arrangements. The document specifying in detail how the procedures laid down in a *safeguards agreement* are to be applied. *Subsidiary arrangements* to *safeguards agreements* consist of a General Part (Codes 1–10), which addresses such matters as points of contact on safeguards and procedures for the application of *IAEA safeguards*, and attachments for *facilities* and *material balance areas (MBAs)* outside *facilities* (*facility/location outside facilities (LOF)* attachments), which detail the safeguards procedures for each individual *facility/location outside facilities (LOF)*.

Safeguards agreements based on [153] require the conclusion of *subsidiary arrangements*. Under an *additional protocol (AP)* based on [540], either the State or the IAEA may request the conclusion of *subsidiary arrangements* to the *AP*. These *subsidiary arrangements* to an *AP* are included in Codes 11–18 of the General Part.

Subsidiary arrangements to an *item-specific safeguards agreement* are concluded if so required by the agreement.

1.31. Modified Code 3.1 of the General Part of the Subsidiary Arrangements to a safeguards agreement. Code 3.1 of the General Part of the *subsidiary arrangements* to a *comprehensive safeguards agreement (CSA)* sets out the timelines for the provision of *design information* by a State to the IAEA for *facilities* and information for *locations outside facilities (LOFs)*. The modified Code 3.1 requires the State to provide to the IAEA early *design information* for a new *facility* as soon as the decision to construct, or to authorize construction of, a new *facility* has been taken, whichever is earlier. The modification was approved in 1992 by the IAEA Board of Governors based on the proposal by the Director

General contained in [2554] and effected by exchanges of letters between the IAEA and States. Prior to the approval of the modified Code 3.1, States were required under Code 3.1 to provide preliminary *design information* for a new *facility* 180 days before *nuclear material* was introduced into the *facility*.

1.32. Voluntary reporting scheme (VRS) on nuclear material and specified equipment and non-nuclear material. The scheme established by the IAEA in 1993 for the voluntary reporting by States of *nuclear material* not otherwise required to be reported to the IAEA under *safeguards agreements*, and of *imports and exports* of specified equipment and non-nuclear material, as specified in [2629]. States choosing to participate in the scheme do so through an exchange of letters with the IAEA. The list of the specified equipment and non-nuclear material to be used for the purpose of the VRS is incorporated in Annex II to [540].

1.33. Notification of transfers of nuclear material to non-nuclear-weapon States. To assist the IAEA in its *safeguards activities*, the five nuclear-weapon States as defined in the *Treaty on the Non-Proliferation of Nuclear Weapons (NPT)* informed the IAEA [207] that they would voluntarily provide to the IAEA information on the anticipated export of *nuclear material* (excluding exports of *source material* for non-nuclear purposes) in an amount exceeding one *effective kilogram (ekg)* for peaceful purposes to any non-nuclear-weapon State at least ten days prior to export. Information is also provided under [207] with respect to each import, in an amount greater than one *effective kilogram (ekg)*, of *nuclear material* which, immediately prior to export, is subject to *IAEA safeguards*, under an agreement with the IAEA, in the State from which the material is imported. The specifications provided in [207] are incorporated to varying degrees in each of the *voluntary offer agreements (VOAs)* between the IAEA and the nuclear-weapon States.

1.34. Neptunium (Np) and americium (Am) monitoring scheme. On the basis of documents [1998] and [1999], the IAEA Board of Governors decided that the IAEA Director General should, using relevant information available through the conduct of the IAEA's regular activities and any additional information provided by States on a voluntary basis, monitor international transfers of *neptunium* and *americium* to non-nuclear-weapon States and any activity to produce separated *neptunium* and *americium* in States with *comprehensive safeguards agreements (CSAs)* in force. With regard to *neptunium*, the Board agreed that the proliferation risk was considerably lower than that with regard to *uranium* or *plutonium* and that exchanges of letters were needed on a voluntary basis between the IAEA and relevant States to ensure the regular and timely receipt of information as well as the application of measures required for efficient implementation of the monitoring scheme described in [1999]. Although the Board believed that there was, at that time (i.e. 1999), practically no proliferation risk with regard to *americium*, it decided that the IAEA Director General should, using relevant information available through the conduct of the IAEA's regular activities and any additional information provided by States on a voluntary basis, including reporting on exports, report to the Board when appropriate with regard to the availability of this material and emerging programmes in States which may lead to acquisition of such material. Following this decision, letters were sent to 39 States seeking relevant information about inventories, exports and separation of *neptunium* and *americium*, and a commitment to provide annual updates. *Flow sheet verification (FSV)* was introduced in [1998] and [1999] as an element of a monitoring approach through which the IAEA Secretariat could (a) provide assurance that quantities of separated *neptunium* and *americium* in States that have, or are obliged to have, a *CSA* remain insufficient to pose a proliferation risk and (b) provide timely notification to the Board if this situation were to change.

GUIDELINES AND RECOMMENDATIONS

1.35. Zangger Committee Export Guidelines. The Guidelines agreed on by a group of States party to the *Treaty on the Non-Proliferation of Nuclear Weapons (NPT)* in order to clarify States' commitments under Article III.2 of the *NPT* in relation to exports, for peaceful purposes, to non-nuclear-weapon States of *source material* or *special fissionable material* and equipment or material especially designed or prepared for the processing, use or production of *special fissionable material*. The Guidelines were first developed during a series of meetings in 1971 chaired by Dr. Claude Zangger of Switzerland and are contained in communications which have been received by the IAEA since 1974 from participating States. The Guidelines consist of a 'trigger list' that includes *source material* and *special fissionable material* and specified equipment and material especially designed or prepared for the processing, use or production of *special fissionable material* whose export requires *IAEA safeguards* on the *source material* or *special fissionable material* in question. The Zangger Committee, as it became known, is not a committee of the IAEA. The IAEA is not a member of the committee and does not participate in its work. The Guidelines are published at the request of States in [209].

1.36. Nuclear Suppliers Group Guidelines. The Guidelines contained in communications received by the IAEA since 1978 from States participating in the Nuclear Suppliers Group (NSG). The Guidelines deal with the export policies and practices of participating States with respect to transfers, for peaceful purposes, to non-nuclear-weapon States of *nuclear material*, equipment and technology, and of nuclear related dual-use equipment, materials, software and related technology. The Guidelines currently consist of two parts:

(a) Part 1 contains guidelines for nuclear transfers and incorporates a 'trigger list' that includes *source material* and *special fissionable material*; nuclear reactors and designated types of nuclear plant (e.g. *reprocessing plants*); equipment especially designed or prepared for such plants; and related technology. This list includes guidelines for nuclear transfers such as physical protection, *IAEA safeguards*, special controls on sensitive exports, special arrangements for export of *enrichment* facilities, controls on material usable for nuclear weapons, controls on retransfers as well as supporting activities.

(b) Part 2 contains guidelines for transfers of nuclear related dual-use equipment, materials, software and related technology, and includes a list specifying such dual-use items that could make a major contribution to a nuclear explosive device or an unsafeguarded *nuclear fuel cycle* activity. The guidelines include fundamental principles for *IAEA safeguards* and export controls that should apply to nuclear transfers for peaceful purposes to any non-nuclear-weapon State and, in the case of controls on retransfer, to transfers to any State.

The IAEA is not a member of the NSG and does not participate in its work. The *NSG Guidelines* were published at the request of Member States in [254, Parts 1 and 2]. In addition, communications from the European Union on a common policy in connection with the Guidelines are reproduced in [322].

1.37. Guidelines for the Management of Plutonium. Guidelines contained in communications received by the IAEA in 1997 from certain Member States regarding policies adopted by these States with a view to ensuring that holdings of *plutonium* are managed safely and effectively in accordance with international commitments, including their obligations under the *Treaty on the Non-Proliferation of Nuclear Weapons (NPT)* (and, for States that are members of the European Union, also under the *Treaty Establishing the European Atomic Energy Community (Euratom Treaty)*); with their *safeguards agreements* with the IAEA; and with other non-proliferation commitments. The Guidelines describe, inter alia, the *nuclear material accountancy* system, physical protection measures and international transfer procedures applicable to the *plutonium* subject to the Guidelines. They further specify the information to be published by the participating States in respect of *plutonium* management, including annual statements of their holdings of civil unirradiated *plutonium* and of their estimates of *plutonium* contained in spent civil reactor fuel. The Guidelines are published in [549].

2. IAEA SAFEGUARDS: PURPOSE, OBJECTIVES AND SCOPE

Safeguards are applied by the IAEA to verify that commitments made by States under safeguards agreements with the IAEA are fulfilled. What follows is an explanation of terms used in connection with the implementation of IAEA safeguards and within the scope of the relevant safeguards agreements and protocols thereto.

2.1. IAEA safeguards. The technical means by which the IAEA verifies States' undertakings under their *safeguards agreements* and protocols thereto (see Section 1).

2.2. IAEA safeguards system. A set of legal instruments, technical measures and administrative procedures implemented by the IAEA in accordance with *safeguards agreements* and protocols thereto, concluded between the IAEA and States or groups of States, in some cases together with a *regional authority responsible for safeguards implementation*, to verify that *nuclear material*, nuclear *facilities* and/or other items subject to safeguards are not acquired or used for proscribed purposes.

The term 'IAEA safeguards system' has been used in the past to refer to *The Agency's Safeguards (1961, extended in 1964)* [26] and *The Agency's Safeguards System (1965, as Provisionally Extended in 1966 and 1968)* [66].

2.3. Purpose of IAEA safeguards. To verify the undertakings of States under their respective *safeguards agreements* with the IAEA.

Independent IAEA verification provides assurance to the international community that States are fulfilling their commitments concerning the peaceful use of nuclear energy and deters States, through the risk of early detection, from acquiring or using *nuclear material*, *facilities* and/or other items subject to safeguards for proscribed purposes. While it is not possible to provide absolute assurance, the IAEA seeks to provide credible assurances to the international community that States are abiding by their safeguards obligations under those agreements. These assurances are provided by the *safeguards conclusions*, which are reported annually in the *Safeguards Implementation Report (SIR).*

2.4. Scope of IAEA safeguards. The scope of application of safeguards as defined by the relevant *safeguards agreement*.

Under a *comprehensive safeguards agreement (CSA)*, safeguards are to be applied on "all source or special fissionable material in all peaceful nuclear activities within the territory of the State, under its jurisdiction or carried out under its control anywhere” [153, para. 2]. Such agreements are as such considered comprehensive (or ‘full scope’). The scope of a *CSA* is not limited to the *nuclear material* declared by a State but rather includes all *nuclear material* subject to *IAEA safeguards* under the agreement.

Under an *item-specific safeguards agreement*, safeguards are applied only to the items specified in the agreement, which may include *nuclear material*, non-nuclear material, services, equipment, *facilities* and information.

Under a *voluntary offer agreement (VOA)*, safeguards are applied to *nuclear material* and/or *facilities* or parts thereof selected by the IAEA from the list of eligible *facilities* provided by the State for the application of *IAEA safeguards*.

2.5. Generic safeguards objectives. Objectives established and pursued by the IAEA Secretariat to verify a State’s fulfilment of its undertakings under its *safeguards agreement* and to draw *safeguards conclusions* for a State. *Generic safeguards objectives* are established on the basis of the scope of the applicable *safeguards agreement*. They are common to all States with the same type of safeguards agreement.

For States with *comprehensive safeguards agreements (CSAs),* the *generic safeguards objectives* are as follows:

— To detect any diversion of declared *nuclear material* at declared *facilities* or *locations outside facilities (LOFs)*;
— To detect any undeclared production or processing of *nuclear material* at declared *facilities* or *LOFs*;
— To detect any undeclared *nuclear material* or activities in the State as a whole.

For States with *item-specific safeguards agreements*, the *generic safeguards objectives* are as follows:

— To detect any *diversion of nuclear material* subject to *IAEA safeguards* under the *safeguards agreement*;
— To detect any *misuse* of facilities and other items subject to *IAEA safeguards* under the *safeguards agreement*.

For States with *voluntary offer agreements (VOAs)*, the *generic safeguards objective* is as follows:

— To detect any withdrawal of *nuclear material* from *IAEA safeguards* in selected *facilities* or parts thereof, except as provided for in the agreement.

2.6. Diversion of nuclear material. The use of *nuclear material* required to be safeguarded for purposes proscribed by the relevant *safeguards agreement*:

(a) Under a *comprehensive safeguards agreement (CSA)*, the removal of *nuclear material* from peaceful activities for the manufacture of nuclear weapons or other nuclear explosive devices or for purposes unknown;
(b) Under an *item-specific safeguards agreement*, the use of *nuclear material* subject to *IAEA safeguards* for the manufacture of nuclear weapons or other nuclear explosive devices and/or to further any other military purpose.

2.7. Misuse. Under an *item-specific safeguards agreement*, this refers to the use of the *nuclear material*, non-nuclear material, equipment or *facilities* specified in the agreement and placed under *IAEA safeguards* to further any proscribed purpose. Under a *comprehensive safeguards agreement (CSA)*, this refers to the undeclared production, processing or use of *nuclear material* subject to *IAEA safeguards* at declared *facilities* or *locations outside facilities (LOFs)*.

An example of *misuse* is the undeclared production of *plutonium* in a safeguarded reactor through the introduction, irradiation and subsequent removal of undeclared *uranium* targets.

2.8. Non-compliance. A violation by a State of its obligations under its *safeguards agreement* with the IAEA.

2.9. Undeclared nuclear material and activities. The term ‘undeclared nuclear material’ refers to *nuclear material* which a State has not declared and placed under *IAEA safeguards* but is required to do so pursuant to its *safeguards agreement* with the IAEA. For a State that has an *additional protocol (AP)* in force, undeclared *nuclear material* also covers *nuclear material* which that State has not declared but is required to do so pursuant to Article 2 of [540]. The term ‘undeclared activities’ refers to nuclear or nuclear related activities which a State has not declared to the IAEA but is required to do so pursuant to its *safeguards agreement* or, where applicable, its *AP*.

2.10. Undeclared facility or location outside facilities (LOF). A nuclear *facility* or a *LOF*, including closed-down *facilities* or *LOFs* and *facilities* under construction, about which a State has the obligation to notify the IAEA in accordance with its *safeguards agreement* and for which no such notification has been given.

2.11. Deterrence. An objective of the application of *IAEA safeguards.* If a State is considering the acquisition of *nuclear material* for a nuclear explosive device, then *IAEA safeguards* may be expected to have a significant deterrent effect through the risk of early detection. Thus, although essentially non-quantifiable, the level of deterrence may be expected to be higher the greater the IAEA's detection capabilities.

2.12. Starting point of safeguards under a CSA. The point at which the safeguards procedures of a *comprehensive safeguards agreement (CSA)* apply to *nuclear material* or other material containing *uranium* or *thorium*.

Paragraph 33 of [153] provides that safeguards shall not apply to material in mining or ore processing activities. Under Article 2.a.(v) of [540], however, a State with an *additional protocol (AP)* is required to provide specified information on *uranium* mines as well as *uranium* and *thorium* concentration plants.

Under paras 34(a) and 34(b) of [153], when a State exports to a non-nuclear-weapon State, directly or indirectly, or imports, any material containing *uranium* or *thorium* which has not reached the stage of the *nuclear fuel cycle* described in para. 34(c) of [153], the State is required to inform the IAEA of the quantity, composition and destination of such *imports and exports*, unless the material is imported or exported for specifically non-nuclear purposes.

Under para. 34(c) of [153], when any *nuclear material* of a composition and purity suitable for fuel fabrication or for being isotopically enriched leaves the plant or the process stage at which it has been produced, or when such *nuclear material*, or any other *nuclear material* produced at a later stage in the *nuclear fuel cycle*, is imported into the State, the *nuclear material* becomes subject to all the other *IAEA safeguards* procedures specified in [153].

Under Article 2.a.(vi) of [540], the State is required to provide the IAEA with information on *source material* which has not reached the composition and purity described in para. 34(c) of [153]. That information is to be provided both on such material present in the State, whether in nuclear or non-nuclear use, and on *imports and exports* of such material for specifically non-nuclear purposes.

2.13. Termination of IAEA safeguards. The discontinuation of the application of *IAEA safeguards* on *nuclear material* or other items subject to safeguards, based on the procedures provided for in the relevant *safeguards agreements* and *subsidiary arrangements* thereto.

Under paras 11 and 35 of [153] and para. 26(c) of [66], *IAEA safeguards* can be terminated upon determination by the IAEA that the *nuclear material* has been consumed, or has been diluted in such a way that it is no longer usable for any nuclear activity relevant from the point of view of safeguards, or has become practicably irrecoverable.

Under para. 12 of [153], *IAEA safeguards* terminate on *nuclear material* transferred out of the State when the recipient State has assumed responsibility therefor, as provided for in para. 91 of [153].

Under para. 26(a) of [66], *IAEA safeguards* terminate on *nuclear material* subject to safeguards if it has been returned to the State that originally supplied it, subject also to other specified conditions in para 26(a).

Under paras 13 and 35 of [153] and para. 27 of [66], *IAEA safeguards* can be terminated on *nuclear material* to be used in non-nuclear activities, such as the production of alloys or ceramics, provided that the IAEA and the State agree that such *nuclear material* is practicably irrecoverable pursuant to para. 11 of [153].

Paragraph 26(d) of [66] provides that *IAEA safeguards* can be terminated, with the agreement of the IAEA, in the case of the *substitution* of material not under safeguards for safeguarded material.

Under Article 2.a.(viii) of [540], the State is to provide the IAEA with information regarding the *location* or further processing of intermediate or high level *waste* containing *plutonium*, *high enriched uranium (HEU)* or ^{233}U on which *IAEA safeguards* have been terminated pursuant to para. 11 of [153].

2.14. Exemption from IAEA safeguards. Under para. 37 of [153] and para. 21 of [66], a State may request *exemption* for *nuclear material* up to certain specified limits.

Under para. 36 of [153], a State may also request *exemption* for *nuclear material* related to the specific use as follows:

(a) *Special fissionable material*, when it is used in gram quantities or less as a sensing component in instruments;
(b) *Nuclear material*, when used in non-nuclear activities in accordance with para. 13 of [153], if such *nuclear material* is recoverable;
(c) *Plutonium* with an isotopic concentration of ^{238}Pu exceeding 80%.

Under para. 38 of [153], if exempted *nuclear material* is to be processed or stored together with safeguarded material, reapplication of *IAEA safeguards* on the exempted material is required. Accordingly, exempted *nuclear material* is required to be de-exempted if such material is to be stored together with safeguarded *nuclear material* or processed.

In certain circumstances there remain some reporting obligations on exempted *nuclear material*.

Under Article 2.a.(vii) of [540], the State is required to provide the IAEA with information regarding the quantities, uses and *locations* of *nuclear material* that has been exempted from *IAEA safeguards* under para. 36(b) or para. 37 of [153].

Paragraphs 22 and 23 of [66] also provide for *exemptions* related to reactors.

2.15. Non-application of safeguards to nuclear material to be used in non-peaceful activities. The use of *nuclear material* in a non-proscribed military activity which does not require the application of *IAEA safeguards*.

More specifically, this refers to the use by a State with a *comprehensive safeguards agreement (CSA)* as envisaged in para. 14 of [153] of *nuclear material* in a nuclear activity which does not require the application of *IAEA safeguards* (e.g. a non-proscribed military activity such as naval nuclear propulsion). The State is required under para. 14(a) of [153] to inform the IAEA that the use of *nuclear material* will not be in conflict with an undertaking the State may have given and in respect of which *IAEA safeguards* apply, that the *nuclear material* will be used only in a peaceful nuclear activity; and that during the period of non-application of *IAEA safeguards* the *nuclear material* will not be used for the production of nuclear weapons or other nuclear explosive devices.

If a State with a *CSA* intends to exercise its discretion to use *nuclear material* which is required to be safeguarded under [153] in a nuclear activity which does not require the application of *IAEA safeguards* under the *CSA*, the IAEA and the State are required to make an arrangement, as provided for in para. 14(b) and 14(c) of [153], so that only while the *nuclear material* is in such an activity, the safeguards provided for in [153] will not be applied. Such an arrangement shall identify, to the extent possible, the period or circumstances during which safeguards will not be applied. Any arrangement pursuant to para. 14 of [153] will be reported to the IAEA Board of Governors.

2.16. Suspension of IAEA safeguards. Under an *item-specific safeguards agreement*, suspension of *IAEA safeguards* may be agreed upon between a State and the IAEA for limited periods and for limited quantities of *nuclear material* while the material is transferred for the purpose of processing, *reprocessing*, testing, research or development [66, para. 24]. Under para. 25 of [66], *IAEA safeguards* on *nuclear material* in irradiated fuel which is transferred for *reprocessing* may be suspended if the State, with the agreement of the IAEA, has substituted therefor *nuclear material* otherwise not subject to *IAEA safeguards*.

2.17. Substitution. A provision available in *item-specific safeguards agreements*, based on paras 25 and 26 of [66], to permit the *suspension of IAEA safeguards* or *termination of IAEA safeguards*, with the agreement of the IAEA, on specific quantities of *nuclear material* or non-nuclear material (e.g. heavy water) if the State submits to *IAEA safeguards nuclear material* or non-nuclear material not otherwise subject to safeguards in accordance with quantity and quality criteria specified in [66]. Substitution is not applicable under a *comprehensive safeguards agreement (CSA)* because under a *CSA* all *nuclear material* in all peaceful nuclear activities in the State is subject to safeguards.

3. SAFEGUARDS CONCEPTS, APPROACHES AND MEASURES

Approaches to safeguards implementation are designed to enable the IAEA to meet its safeguards objectives. What follows is an explanation of the basic concepts and approaches underlying the development and application of IAEA safeguards and the measures available to the IAEA under safeguards agreements and, as applicable, under additional protocols.

3.1. State-level concept (SLC). The general notion of implementing *IAEA safeguards* in a manner that considers a State's nuclear and nuclear related activities and capabilities as a whole, within the scope of the *safeguards agreement*.

Background: The IAEA Secretariat first used the term 'State-level concept' in the *Safeguards Implementation Report (SIR)* for 2004 to describe safeguards implementation and evaluation based on a *State-level safeguards approach (SLA)* developed for each individual State. 'State as a whole' considerations for safeguards purposes were introduced in the context of the IAEA's efforts in the 1990s to strengthen the effectiveness and efficiency of *IAEA safeguards* following the discovery of *undeclared nuclear material and activities* at undeclared *locations* in some States with *comprehensive safeguards agreements (CSAs)*. This involved greater consideration of the State's *nuclear fuel cycle* as a whole (as opposed to *IAEA safeguards* primarily focused on *nuclear material* at declared *facilities* and *locations outside facilities (LOFs)*) for the purpose of ensuring that the IAEA is able to exercise its right and fulfil its obligation to ensure that *IAEA safeguards* are applied on all *nuclear material* in all peaceful nuclear activities in a State with a *CSA*, as provided for in para. 2 of [153].

To that end, in 1993 the IAEA embarked on *Programme 93+2* to further strengthen implementation of *IAEA safeguards* under *CSAs* by enhancing the IAEA's ability to verify not only the correctness but also the completeness of a State's declaration. This programme led to the adoption of the *Model Additional Protocol* in 1997. In 1999, the IAEA drew the first *broader conclusion*, for a State which had both a *CSA* and an *additional protocol (*AP*)* in force, that all *nuclear material* in the State remained in peaceful activities.

The IAEA began developing and implementing *SLAs* for individual States in the early 2000s, beginning with those States for which it had drawn the *broader conclusion* and could therefore implement *integrated safeguards*, optimizing the implementation of *safeguards measures* under *CSAs* and *APs*.

The *SIR* for 2004 stated that the application of the *SLC*, based on an *SLA* developed for each individual State, was planned to be extended to all the other States with *CSAs*.

In 2011, the IAEA began to update existing *SLAs* (for States under *integrated safeguards*) and to develop *SLAs* for other States, customizing the *SLAs* through more systematic consideration and better use of the *State-specific factors* and moving away from *model (generic) facility safeguards approaches*. The concept was further elaborated in reports to the IAEA Board of Governors in [2013] and [2014]. The latter document described the SLC as applicable for all States with a *safeguards agreement* in force, within the scope of the respective *safeguards agreement* and protocols thereto. It also explained that the *SLC* does not entail the introduction of any additional rights or obligations on the part of either States or the IAEA, nor any modification in the interpretation of existing rights and obligations. Since 2014, all *SLAs* have been developed as described in [2013] and [2014].

3.2. State-level safeguards. The implementation of *IAEA safeguards* based on the *State-level concept (SLC)*. State-level safeguards are also referred to as 'implementation of safeguards at the State level'. State-level safeguards entail the development of a customized *State-level safeguards approach (SLA)* to implement *IAEA safeguards* for an individual State.

3.3. State-specific factors (SSFs). The six objective safeguards relevant factors that are particular to a State which are used by the IAEA Secretariat in the development of a *State-level safeguards approach (SLA)* and in the planning, conduct and evaluation of *safeguards activities* for that State. The SSFs are based on factual information and are objectively assessed.

The exhaustive list of six SSFs is as follows:

(a) The type of *safeguards agreement* in force for the State and the nature of the *safeguards conclusion* drawn by the IAEA. For example, a State has a *comprehensive safeguards agreement (CSA)* and an *additional protocol (AP)* in force and the *broader conclusion* has not been drawn.

(b) The *nuclear fuel cycle* and related technical capabilities of the State. For example, the State has a nuclear *power reactor* and *locations outside facilities* (*LOFs)*, and limited *nuclear fuel cycle* related industrial capabilities.

(c) The technical capabilities of the *State (or regional) system of accounting for and control of nuclear material (SSAC/RSAC)*. For example, the *State or regional authority responsible for safeguards implementation (SRA)* conducts national/regional inspections or audits and the *nuclear material* measurement methods at bulk facilities meet *international target values (ITVs)*.

(d) The ability of the IAEA to implement certain *safeguards measures* in the State. For example, whether conditions exist to effectively implement *short notice random inspections (SNRIs)* or *remote data transmission (RDT)* is permitted.

(e) The nature and scope of cooperation between the State and the IAEA in the implementation of safeguards. For example, the timeliness and completeness of State reports, the facilitation of inspector access.
(f) The IAEA's experience in implementing *IAEA safeguards* in the State. For example, existing or recurring field conditions adverse to safeguards, a State allowing its *facility* operators to apply IAEA electronic *seals* to items being shipped.

3.4. Safeguards approach. An internal document developed by the IAEA describing the practical implementation of *IAEA safeguards*. A *safeguards approach* consists of a set of *safeguards measures* and *safeguards activities,* along with their corresponding *intensity* and *frequency*.

Safeguards approaches may be developed for the State as a whole (i.e. a *State-level safeguards approach (SLA)*) or for separate elements of a State's *nuclear fuel cycle* for the State concerned (referred to as 'sub-approaches' if an *SLA* is implemented). In the absence of an *SLA*, *safeguards approaches* are based primarily on the *Safeguards Criteria*. Separate approaches (or sub-approaches in the context of an *SLA*) may cover elements of a State's *nuclear fuel cycle*, for example the following:

(a) *Facility*: the approach for implementation of *IAEA safeguards* at a specific *facility*.
(b) *Site*: a *safeguards approach* for a particular group of *facilities* located on the same *site*.
(c) Sector: a *safeguards approach* for a group of *facilities* in a State which are of the same type, or produce or process the same type and form of *nuclear material*, or are located in close proximity to one another.
(d) Zone: a *safeguards approach* for all *nuclear material* of a specified category or type in all or in a specified subset of *material balance areas (MBAs)* within a State.

3.5. State-level safeguards approach (SLA). A customized approach to implementing *IAEA safeguards* for an individual State. An *SLA* is detailed in an internal document developed by the IAEA Secretariat.

To develop an *SLA*, the IAEA conducts an *acquisition path analysis* or a *diversion path analysis* and takes into account the *State-specific factors*. An *SLA* consists of *technical objectives* as well as applicable *safeguards measures* and *safeguards activities*, along with their corresponding *frequency* and *intensity*, to be implemented in the field and at IAEA Headquarters to address those objectives. In developing and implementing an *SLA* for a State, the IAEA consults with the *State and/or regional authority responsible for safeguards implementation (SRA)*, particularly on the implementation of in-field *safeguards measures*. In practice, the *SLA* is implemented through *safeguards activities* scheduled in the *annual implementation plan (AIP)* for the State.

In cases of complex *nuclear fuel cycles*, an *SLA* may consist of a high level document and several sub-approaches.

3.6. Broader conclusion. A *safeguards conclusion*, drawn by the IAEA Secretariat for a State with a *comprehensive safeguards agreement (CSA)* and an *additional protocol (AP)* in force, that all *nuclear material* in a State remains in peaceful activities.

A *broader conclusion* is drawn on the basis of a comprehensive evaluation by the IAEA of all *safeguards relevant information* available to it and the Secretariat's finding that there are no indications of diversion of declared *nuclear material* from peaceful nuclear activities in a State, no indications of undeclared production or processing of *nuclear material* at declared *facilities* and *locations outside facilities (LOFs)* and no indications of undeclared *nuclear material* or activities in a State as a whole. When the evaluation has been completed, and no indication has been found by the IAEA that, in its judgement, would give rise to a safeguards concern, the Secretariat can draw the *broader conclusion* that all *nuclear material* in a State remains in peaceful activities.

3.7. Integrated safeguards. An optimized combination of all *safeguards measures* available to the IAEA under *comprehensive safeguards agreements (CSAs)* and *additional protocols (APs). Integrated safeguards* may be implemented for States for which the IAEA has drawn the *broader conclusion*. They are aimed at optimizing the effectiveness and efficiency of safeguards implementation for those States.

Background: *Safeguards approaches* under *integrated safeguards* were initially developed and implemented on the basis of a conceptual framework reported to the IAEA Board of Governors in [2002] and reflected the additional measures available to the IAEA under an *AP* as well as enhanced understanding of a State's overall *nuclear fuel cycle*. Integrated safeguards were an important step in the implementation of *State-level safeguards* as the IAEA began to develop, document and implement individual *State-level safeguards approaches* and *annual implementation plans (AIPs)* for the first group of States (i.e. those for which it had drawn the *broader conclusion*). For these States, because of the assurances regarding the absence of *undeclared nuclear material and activities* in the State as a whole, at certain *facilities safeguards measures* could be applied at reduced levels compared with the *Safeguards Criteria* levels that would have been applied without a *broader conclusion*.

Safeguards approaches under *integrated safeguards* were based on *model (generic) facility safeguards approaches*, as described in [2002]. Later, these approaches were customized and updated on the basis of *acquisition path analysis* for the State concerned, as elaborated in reports to the IAEA Board of Governors [2013] and [2014].

3.8. Programme 93+2. A programme initiated by the IAEA in 1993, described in [2784] and [2807], that proposed measures to strengthen the effectiveness and improve the efficiency of the *IAEA safeguards system* and to increase the IAEA's capability to verify both the correctness and the completeness of *nuclear material* declarations under a *comprehensive safeguards agreement (CSA)*. This programme involved proposals for measures that could be pursued both within the IAEA's existing legal authority under *CSAs* (referred to as Part I measures) and on the basis of complementary legal authority to be conferred by States (referred to as Part II measures), which led to the adoption of the *Model Additional Protocol* in 1997.

3.9. Model (generic) facility safeguards approaches. Approaches for particular *facility* types that were developed under the conceptual framework for *integrated safeguards* [2002].

3.10. Safeguards Criteria. A set of *nuclear material* verification activities, and their *frequency* and *intensity*, for each *facility* type and for *locations outside facilities (LOFs)* based on the associated quantity and type of *nuclear material*.

The *Safeguards Criteria* were developed by the IAEA between 1988 and 1995. The *frequency* and *intensity* specified in the *Safeguards Criteria* are based on the premise that the existence in a State of the necessary capabilities to convert diverted *nuclear material* into a form suitable for use in a nuclear weapon or other nuclear explosive device cannot be ruled out, regardless of *State-specific factors*.

3.11. Safeguards measures. Measures available to the IAEA under a *safeguards agreement* and, where applicable, an *additional protocol (AP)*. Examples of such measures include *nuclear material accountancy*, *inspections*, *design information verification (DIV)* and *complementary access.*

3.12. Safeguards activities. Implementation of *safeguards measures* in the field or at IAEA Headquarters according to established procedures. Examples of such activities include examination and comparison of records and reports; *material balance evaluation*; verification of *nuclear material*; *verification of the operator's measurement system*; sampling for *destructive analysis (DA)*; application, verification and checking the integrity of *seals*; application of *surveillance* systems and review of results; *transit matching* analysis; taking of *environmental samples* for analysis; and analysis of *safeguards relevant information*.

3.13. Diversion path analysis. A structured method used to analyse the paths by which, from a technical point of view, *nuclear material* subject to *IAEA safeguards* could be diverted from a *facility*, or by which *facilities* or other items subject to safeguards could be *misused*. Diversion path analysis is used to establish *technical objectives* for States with an *item-specific safeguards agreement* and States with a *voluntary offer agreement (VOA)*. For States with a *VOA*, the path analysis includes consideration of the withdrawal from safeguards of *nuclear material* subject to safeguards without notifying the IAEA.

3.14. Acquisition path analysis. A structured method used to analyse the plausible paths by which, from a technical point of view, *nuclear material* suitable for use in a nuclear weapon or other nuclear explosive device could be acquired. Acquisition path analysis is used to establish *technical objectives* for a State with a *comprehensive safeguards agreement (CSA)* in force. It does not involve judgements about a State's intention to pursue any such path.

3.15. Acquisition path. A sequence of steps which a State could follow to acquire one *significant quantity (SQ)* of *nuclear material* (in metallic form) suitable for use in a nuclear weapon or other nuclear explosive device.

For example, the following three steps comprise one acquisition path: (i) the diversion of declared spent fuel; (ii) undeclared *reprocessing* at a declared *facility*; and (iii) undeclared conversion to *plutonium* metal at an undeclared *location*.

3.16. Protracted diversion. *Diversion of nuclear material* in a series of small fractional amounts of declared *inventory*, accumulating in a *significant quantity (SQ)* over a *material balance period (MBP)*.

Indications of protracted diversion can be detected through *safeguards activities*, for example through *material balance evaluation*.

3.17. Abrupt diversion. Diversion of a *significant quantity (SQ)* of *nuclear material* from the declared *inventory* in a single action. A diversion of a smaller amount of *nuclear material* in a single action may be also considered *abrupt diversion* if it represents a large fraction of the declared *inventory*.

Indications of *abrupt diversion* can be detected through *safeguards activities*, for example *interim inventory verification (IIV)* inspection.

3.18. Concealment methods. Actions taken within a given *diversion path* or a given *acquisition path* to reduce the probability of detection by IAEA *safeguards* *activities*. Such actions may begin before the removal of material and may be continued over a considerable time. Examples include the following:

(a) Tampering with IAEA *containment/surveillance measures* or interfering with *nuclear material accounting* activities.
(b) Falsifying records, reports and other documents by overstating decreases in *inventory* (e.g. shipments, *measured discards*) or by understating increases to *inventory* (e.g. receipts, production), or by presenting false *facility* operational data. These are all examples of *diversion into D*.
(c) For *bulk handling facilities, diversion into MUF* (*material unaccounted for*), *diversion into SRD* (*shipper/receiver difference*) or *diversion into D*.
(d) Borrowing *nuclear material* from other *facilities* in the State to replace the diverted *nuclear material* for the duration of an IAEA *inspection*.
(e) Replacing diverted *nuclear material* or other missing items with material or items of lower strategic value (e.g. dummy fuel assemblies or elements).
(f) Creating obstacles to access by *IAEA inspectors* so as to reduce the possibility of their detecting a *diversion of nuclear material*.

3.19. Significant quantity (SQ). The approximate amount of *nuclear material* for which the possibility of manufacturing a nuclear explosive device cannot be excluded. *SQs* take into account unavoidable losses due to conversion and manufacturing processes and should not be confused with critical masses. They are used in establishing the *quantity component* of the *IAEA inspection goal. SQ* values currently in use are given in Table 1.

3.20. Conversion time. The time required to convert different forms of *nuclear material* into the metallic components of a nuclear explosive device. *Conversion time* is used to determine timely detection requirements under the *Safeguards Criteria*. *Conversion time* is estimated on the basis of the assumptions that all necessary conversion and manufacturing *facilities* exist, that processes have been tested (e.g. by manufacturing dummy components using appropriate surrogate materials), and that non-nuclear components of the device have been manufactured, assembled and tested. It does not include the time required to transport diverted material to the conversion *facility*, the time required to assemble the device, nor any subsequent time period. The *conversion time* estimates applicable under the above assumptions are provided in Table 2.

3.21. Detection time. An estimate of the time available for detection of a step in an *acquisition path* (e.g. the time from diversion until the end of the path). *Detection time* is a parameter used in the planning of the *frequency* of *safeguards measures* and *safeguards activities* for timely detection purposes.

TABLE 1. SIGNIFICANT QUANTITY (SQ) VALUES CURRENTLY IN USE

Material	*SQ*
Direct use nuclear material	
Plutonium[a]	8 kg *plutonium*
^{233}U	8 kg ^{233}U
High enriched uranium (HEU) (^{235}U ≥ 20%)	25 kg ^{235}U
Indirect use nuclear material	
Uranium (^{235}U < 20%)[b]	75 kg ^{235}U (or 10 t *natural uranium* or 20 t *depleted uranium*)
Thorium	20 t *thorium*

[a] For *plutonium* containing less than 80% ^{238}Pu.

[b] Including *low enriched uranium (LEU)*, *natural uranium* and *depleted uranium*.

TABLE 2. ESTIMATED MATERIAL CONVERSION TIMES FOR FINISHED PLUTONIUM OR URANIUM METAL COMPONENTS

Beginning *material form*	*Conversion time*
Plutonium, *high enriched uranium (HEU)* or ^{233}U metal	Order of days (7–10)
PuO_2, $Pu(NO_3)_4$ or other pure *plutonium* compounds; *HEU* or ^{233}U oxide or other pure *uranium* compounds; *mixed oxide (MOX)* or other unirradiated pure mixtures containing *plutonium*, *uranium* (^{233}U + ^{235}U ≥ 20%); *plutonium*, *HEU* and/or ^{233}U in *scrap* or other miscellaneous impure compounds	Order of weeks (1–3)[a]
Plutonium, *HEU* or ^{233}U in irradiated fuel	Order of months (1–3)
Uranium containing <20% ^{235}U and ^{233}U; *thorium*	Order of months (3–12)

[a] This range is not determined by any single factor, but the pure *plutonium* and *uranium* compounds will tend to be at the lower end of the range and the mixtures and *scrap* at the higher end.

3.22. Technical objectives. Objectives established for a State, through the conduct of *acquisition path analysis* or *diversion path analysis*, to guide the planning, conduct and evaluation of *safeguards activities*.

The IAEA seeks to address the *technical objectives* to detect and deter any proscribed activity along a possible *acquisition path* or *diversion path*. The *technical objectives* support the IAEA Secretariat in addressing the *generic safeguards objectives*. The prioritization of technical objectives aims at the concentration of safeguards effort on areas of greater safeguards significance.

3.23. Technical objective performance target. The degree to which a *technical objective* should be addressed in a *State-level safeguards approach (SLA)* (e.g. the required *detection probability* for the diversion of 1 *significant quantity (SQ)* of *nuclear material* within a period of time). *Safeguards measures* and *safeguards activities*, along with their *frequency* and *intensity*, are selected during *SLA* development to meet these targets.

3.24. Verification effort. The level of *safeguards activities* conducted by the IAEA for the State, both in the field and at IAEA Headquarters. In the field, the level of effort can be expressed as the *frequency* and the *intensity* of the activities (i.e. how often and the extent to which they are conducted).

3.25. Intensity of safeguards activity. A parameter defining the amount of effort associated with a given *safeguards activity* or the extent of verification required.

For example, the intensity of fresh fuel verification during an *inspection* could involve item counting and verification with 50% *detection probability* for gross *defects*.

3.26. Frequency of safeguards activity. A parameter defining how often a given *safeguards activity* needs to be conducted.

3.27. IAEA inspection goal. The goal specified for IAEA verification activities at a given *facility* based on the *Safeguards Criteria*. The inspection goal for a *facility* consists of a *quantity component* and a *timeliness component*.

3.28. Quantity component (of the IAEA inspection goal). Relates to the scope of the *inspection activities* at a *facility* that are necessary for the IAEA to be able to draw the conclusion that there has been no diversion of 1 *significant quantity (SQ)* or more of *nuclear material* over a *material balance period (MBP)* and that there has been no undeclared production or separation of *direct use material* at the *facility* over that period.

3.29. Timeliness component (of the IAEA inspection goal). Relates to the periodic activities that are necessary for the IAEA to be able to draw the conclusion that there has been no *abrupt diversion* of 1 *significant quantity (SQ)* or more at a *facility* during a calendar year.

3.30. Annual implementation plan (AIP). An annual plan developed for each State on the basis of the relevant *safeguards approach*, consisting of a schedule of *safeguards activities* to be conducted for a State during a given calendar year in order to address the *technical objectives*. The *AIP* is an internal IAEA document that can be updated during the course of the year to take into account any needed follow-up actions resulting from the conduct of *safeguards activities* or new information.

3.31. Design information. Information concerning *nuclear material* subject to *IAEA safeguards* under the relevant agreement and the features of facilities relevant to safeguarding such material (see para. 8 of [153]; see also para. 32 of [66]).

Design information includes the *facility* description; the form, quantity, *location* and flow of *nuclear material* to be or being used; *facility* layout and *containment* features; and procedures for *nuclear material accountancy* and *nuclear material control*. This information is used by the IAEA, inter alia, to design the *facility safeguards approach*, to determine *material balance areas (MBAs)* and select *key measurement points (KMPs)* and other *strategic points*, to develop the *design information verification (DIV)* plan and to establish the *essential equipment list (EEL)*.

Design information for existing facilities should be provided by the State during discussion of the *subsidiary arrangements*; in the case of new facilities, such information is to be provided by the State as early as possible before *nuclear material* is introduced into a new *facility*. Further, the State is to provide preliminary information on any new nuclear *facility* as soon as the decision is taken to construct, or to authorize the construction of, the *facility*, and to provide further information on the safeguards relevant features of *facility* design early in the stages of project definition, preliminary design, construction and commissioning. *Facility* design information is to be provided for any safeguards relevant changes in operating conditions throughout the *facility life cycle*, including decommissioning. Under an *item-specific safeguards agreement*, the State is to provide design information on principal nuclear facilities to enable the IAEA to perform the design review at as early a stage as possible [66, para. 31]. Design information is submitted to the IAEA by the State using the IAEA *design information questionnaire (DIQ)*.

3.32. Design information questionnaire (DIQ). A document submitted by States to provide information on the design of a *facility* in accordance with para. 42

of [153] and within the time limits specified in the *subsidiary arrangements*. An updated *DIQ* is submitted whenever there is a planned modification relevant for safeguards purposes or a significant change in the *facility* design or operating practices, and as specified in the *subsidiary arrangements*. The IAEA provides States with standard forms to record and submit the *design information* required by it for the different *facility* types and for *locations outside facilities (LOFs)*.

3.33. Design information examination (DIE). Activities carried out by the IAEA to determine that the State has provided all relevant descriptive and technical information needed, inter alia, to design a *safeguards approach* for a specific *facility*.

3.34. Essential equipment list (EEL). A list of equipment, systems and structures essential for the operation of a *facility*. The *EEL* is facility specific and is established during the *design information examination (DIE)*. It identifies those items that may influence the *facility's* operational status, function, capabilities and *inventory*.

3.35. Flowsheet verification (FSV). In the context of the *neptunium* (*Np) and americium (Am) monitoring scheme*, *FSV* addresses the *acquisition path* whereby a State could accumulate quantities of separated *neptunium* and/or *americium* through separation activities at relevant facilities in the State (i.e. facilities which have *nuclear material* containing *neptunium* and/or *americium* and the actual or potential capability for separating these materials).

FSV is meant to provide direct confirmation that these facilities are being operated as declared. The *FSV* concept and general implementation provisions are described in [1998] and [1999]. Further advice from the IAEA Secretariat on technical parameters and modalities which could be applied to distinguish between *neptunium* and *americium* in the implementation of the monitoring scheme is given in the Attachment to [1999].

3.36. Quality management system of the IAEA Department of Safeguards. A formalized system that documents processes, procedures and responsibilities for achieving quality policies and objectives. The quality management system is the primary mechanism to ensure that *safeguards activities* are undertaken in an efficient, effective and consistent fashion providing oversight of the key *IAEA safeguards* processes to ensure impartiality, effectiveness and efficiency of safeguards implementation.

4. NUCLEAR MATERIAL, NON-NUCLEAR MATERIAL, NUCLEAR INSTALLATIONS AND NUCLEAR RELATED ACTIVITIES

Safeguards agreements between a State (or States) and the IAEA and protocols thereto set out the provisions and procedures for the application of IAEA safeguards on nuclear material, non-nuclear material, facilities, equipment and locations and/or for information to be provided in respect of nuclear related activities in the State (or States). In addition, States may have arrangements with the IAEA relating to the provision to the IAEA of additional information on nuclear related activities and on the import and/or export of specified equipment. What follows is an explanation of safeguards relevant terms used in connection with nuclear material, non-nuclear material, facilities, equipment, locations and information on nuclear related activities.

4.1. Nuclear material. Any *source material* or *special fissionable material* as defined in Article XX of the *Statute of the IAEA*; see also para. 112 of [153], para. 77 of [66] and Article 18.h of [540].

4.2. Nuclide. A species of atom characterized by the number of protons (atomic number) and the number of protons and neutrons together (mass number).

4.3. Isotope. One of two or more atoms of the same element that have the same number of protons in their nucleus but different numbers of neutrons. *Isotopes* have the same atomic number but different mass numbers. *Isotopes* of an element are denoted by indicating their mass numbers as *superscripts* preceding the element symbol (e.g. ^{233}U, ^{239}Pu) or as numbers following the name or symbol of the element (e.g. *uranium-233*, Pu-239). Some isotopes are unstable to the extent that their decay needs to be considered for *nuclear material accountancy* purposes (e.g. ^{241}Pu has a half-life of 14.35 years).

4.4. Source material. As defined in the *Statute of the IAEA* (Article XX.3):

> "[U]ranium containing the mixture of isotopes occurring in nature; uranium depleted in the isotope 235; thorium; any of the foregoing in the form of metal, alloy, chemical compound, or concentrate; any other material containing one or more of the foregoing in such concentration as the Board of Governors shall from time to time determine; and such other material as the Board of Governors shall from time to time determine".

According to para. 112 of [153]:

> "The term source material shall not be interpreted as applying to ore or ore residue. Any determination by the Board under Article XX of the Statute after the entry into force of this Agreement which adds to the materials considered to be source material or special fissionable material shall have effect under this Agreement only upon acceptance by the State".

See also Article 18.h of [540].

Ore concentrate is considered to be *source material*.

4.5. Special fissionable material. As defined in the *Statute of the IAEA* (Article XX.1):

> "[P]lutonium-239; uranium-233; uranium enriched in the isotopes 235 or 233; any material containing one or more of the foregoing; and such other fissionable material as the Board of Governors shall from time to time determine; but the term 'special fissionable material' does not include source material."

See also para. 112 of [153] and Article 18.h of [540].

4.6. Fissionable material. In general, an *isotope* or a mixture of *isotopes* capable of nuclear fission. Some *fissionable materials* are capable of fission only by sufficiently fast neutrons (e.g. neutrons with kinetic energy above 1 MeV).

Isotopes that undergo fission by neutrons of all energies, including slow (thermal) neutrons, are usually referred to as fissile material or fissile *isotopes*. For example, ^{233}U, ^{235}U, ^{239}Pu and ^{241}Pu are referred to as both fissionable and fissile, while ^{238}U and ^{240}Pu are fissionable but not fissile.

4.7. Fertile material. A type of *nuclear material* that can be converted into a *special fissionable material* through the capture of one neutron per nucleus. There are two naturally occurring *fertile materials*: ^{238}U and ^{232}Th. Through the capture of neutrons followed by two beta decays, these *fertile materials* are converted into fissionable ^{239}Pu and ^{233}U, respectively.

4.8. Uranium. A naturally occurring radioactive element with atomic number 92 and symbol U. *Natural uranium* contains *isotopes* ^{234}U, ^{235}U and ^{238}U; *uranium isotopes* ^{232}U, ^{233}U and ^{236}U are produced by *transmutation*.

4.9. Natural uranium. *Uranium* as it occurs in nature, with an atomic weight of approximately 238 and containing minute quantities of ^{234}U, about 0.7% ^{235}U and 99.3% ^{238}U. *Natural uranium* is usually supplied in raw form by *uranium* mines and concentration (ore processing) plants as *uranium* ore concentrate, most commonly the concentrated crude oxide U_3O_8, often called 'yellowcake'.

4.10. Depleted uranium. *Uranium* in which the abundance of the *isotope* ^{235}U is less than that occurring in *natural uranium*, for example *uranium* in spent fuel from *natural uranium* fuelled reactors and tails from *uranium enrichment* processes.

4.11. Low enriched uranium (LEU). Enriched *uranium* containing less than 20% in weight per cent (wt%) of the *isotope* ^{235}U. *LEU* is considered a *special fissionable material* and an *indirect use material*.

4.12. High enriched uranium (HEU). Enriched *uranium* containing 20% or more in weight percent of the *isotope* ^{235}U [540, Article 18.e]. *HEU* is considered a *special fissionable material* and a *direct use material*.

4.13. Uranium-233. An *isotope* of *uranium* which is produced by the *transmutation* of ^{232}Th by irradiating *thorium* fuel in a reactor. *Uranium-233* is considered a *special fissionable material* and a *direct use material*.

4.14. Plutonium. A radioactive element which occurs only in trace amounts in nature, with atomic number 94 and symbol Pu. Produced by irradiating *uranium* fuels, *plutonium* contains varying percentages of the *isotopes* ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu and ^{242}Pu. *Plutonium* containing any ^{239}Pu is considered a *special fissionable material* and, except for *plutonium* containing 80% or more of ^{238}Pu, a *direct use material*.

4.15. Mixed oxide (MOX). A mixture of the oxides of *uranium* and *plutonium* used as reactor fuel for the recycling of *plutonium* in thermal nuclear reactors ('thermal recycling') and for fast reactors. *MOX* is considered a *special fissionable material* and a *direct use material*.

4.16. Thorium. A radioactive element with atomic number 90 and symbol Th. Naturally occurring *thorium* consists only of the fertile *isotope* ^{232}Th, which through *transmutation* becomes the fissionable *^{233}U*.

4.17. Americium. A radioactive element with atomic number 95 and symbol Am. *Isotopes* of *americium*, which are formed by neutron capture or by the decay of

^{241}Pu, are fissionable and may have the potential to be used in a nuclear explosive device. While not defined by the *Statute of the IAEA* as *source material* or *special fissionable material,* information on separated *americium* is collected by the IAEA under the *neptunium (Np) and americium (Am) monitoring scheme* with relevant States. *Americium* has sometimes been referred to as an 'alternative nuclear material'.

4.18. Neptunium. A radioactive element with atomic number 93 and symbol Np. The *isotope* ^{237}Np is both fissionable and fissile; it is formed during the irradiation of fuel in reactors and may be separated from high level *waste* and *reprocessing* streams. While not defined by the *Statute of the IAEA* as *source material* or *special fissionable material,* separated *neptunium* is monitored by the IAEA under the *neptunium (Np) and americium (Am) monitoring scheme* with relevant States. *Neptunium* has been referred to as an 'alternative nuclear material.'

4.19. Enrichment. The relative amount (i.e. ratio) of a particular *isotope* (stable or radioactive) compared with the total amount of all *isotopes* of the same chemical element within a sample. *Enrichment* is usually stated as a percentage, either by weight (wt%) or isotopic abundance. The term *'enrichment'* also refers to the process by which the ratios of the *isotopes* of a given chemical element (stable or radioactive) are altered, such as the production of enriched *uranium* or heavy water.

In para. 105 of [153] and para. 73 of [66], this term refers to "the ratio of the combined weight of the isotopes uranium-233 and uranium-235 to that of the total uranium in question."

4.20. Depletion. Any process by which the abundance of a specified *isotope* (e.g. a fissile *isotope*) in an element is reduced, such as the stripping process in an *enrichment plant*, the burnup of nuclear fuel in a reactor or radioactive decay (e.g. the decay of ^{241}Pu contained in spent fuel).

4.21. Transmutation. The conversion of one *nuclide* into another through one or more nuclear reactions, and more specifically, the conversion of an *isotope* of one element into an *isotope* of another element through one or more nuclear reactions. For example, ^{238}U is converted into ^{239}Pu by neutron capture followed by the emission of two beta particles.

4.22. Reprocessing. The separation of *nuclear material* from fission products in irradiated *nuclear material*.

4.23. Material type. Classification of *nuclear material* according to the element contained and, for *uranium*, the level of *enrichment*. The types are *plutonium*, *high enriched uranium (HEU)*, ^{233}U, *depleted uranium*, *natural uranium*, *low enriched uranium (LEU)* and *thorium*.

4.24. Material category. Categorization of *nuclear material* according to its irradiation status and suitability for conversion into components of nuclear explosive devices. The categories are unirradiated *direct use material*, irradiated *direct use material* and *indirect use material*.

4.25. Direct use material. *Nuclear material* that can be used for the manufacture of nuclear explosive devices without *transmutation* or further *enrichment*. It includes *plutonium* containing less than 80% ^{238}Pu, *high enriched uranium (HEU)* and ^{233}U. Chemical compounds, mixtures of direct use materials (e.g. *mixed oxides (MOX)*) and *plutonium* in spent reactor fuel fall into this category. Unirradiated *direct use material* is *direct use material* which does not contain substantial amounts of fission products; it would require less time and effort to be converted into components of nuclear explosive devices than would irradiated *direct use material* (e.g. *plutonium* in spent reactor fuel) that contains substantial amounts of fission products.

4.26. Indirect use material. All *nuclear material* except *direct use material*. It includes *depleted uranium*, *natural uranium*, *low enriched uranium (LEU)* and *thorium*, all of which must be processed further to produce *direct use material*.

4.27. Material form. Classification of *nuclear material* according to its physical form; material can be either in ‘item form’ or in ‘bulk form’. Material is in item form as long as it consists of individually identifiable units (e.g. fuel assembly, bundle, pin, plate or coupon, drum or other container). Bulk material is material in loose form, such as liquid, gas or powder, or in a large number of small units (e.g. pellets) that are not each individually identified for *nuclear material accountancy* purposes.

4.28. Improved nuclear material. As defined in para. 74 of [66], *nuclear material* that has been altered in such a way that one of the following is the case:

“(a) The concentration of fissionable isotopes in it has been increased; or
(b) The amount of chemically separable fissionable isotopes in it has been increased; or
(c) Its chemical or physical form has been changed so as to facilitate further use or processing.”

4.29. Effective kilogram (ekg). A special unit used in the safeguarding of *nuclear material*. As described in para. 104 of [153] and para. 72 of [66], the quantity of *nuclear material* in *ekg* is obtained by taking the following:

(a) For *plutonium*, its weight in kilograms;
(b) For *uranium* with an *enrichment* of 0.01 (1%) and above, its weight in kilograms multiplied by the square of its *enrichment*;
(c) For *uranium* with an *enrichment* below 0.01 (1%) and above 0.005 (0.5%), its weight in kilograms multiplied by 0.0001;
(d) For *depleted uranium* with an *enrichment* of 0.005 (0.5%) or below, and for *thorium*, its weight in kilograms multiplied by 0.00005.

4.30. Feed material. *Nuclear material* introduced at the start of a process operation, for example UF_6 as the feed for an *enrichment* process or for a UO_2 conversion process, or UO_2 as the feed for a fuel fabrication operation.

4.31. Scrap. Recyclable *nuclear material* rejected from the process stream. Clean *scrap* comprises rejected process material that can be reintroduced into the process stream without the need for purification, while dirty *scrap* may require separation of the *nuclear material* from contaminants, or chemical treatment to return the material to a state acceptable for subsequent processing.

4.32. Waste. In the context of *IAEA safeguards*, this refers to waste containing *nuclear material* in concentrations or chemical forms which make the *nuclear material* no longer usable for any nuclear activity relevant from the point of view of safeguards, or which has become practicably irrecoverable. Reporting requirements to the IAEA for *nuclear material* contained in *waste* are specified under the relevant *safeguards agreement* and *additional protocol (AP)* thereto, as applicable. The *termination of IAEA safeguards* on *nuclear material* in *waste* is based on a determination by the IAEA that certain of the relevant technical conditions are met. Under an *INFCIRC/153-type safeguards agreement*, where these conditions are not met but the State considers that the recovery of safeguarded *nuclear material* from residues is not for the time being practicable or desirable, para. 35 of [153] provides that the IAEA and the State shall consult on the *safeguards measures* to be applied, in which case the *nuclear material* remains subject to *IAEA safeguards* but is reported to the IAEA as transferred to *retained waste* and is no longer included in the *inventory* of the *material balance area (MBA)*.

4.33. Hold-up. *Nuclear material* remaining in and about process equipment, interconnecting piping, filters and adjacent work areas after shutdown of a plant.

It may also be referred to as ‘material held up in process’ or ‘in-process material’ for plants in operation. *Hold-up* is difficult to measure and may be a contributor to *material unaccounted for (MUF),* and therefore is important to minimize prior to conducting a *physical inventory* taking. Some material in *hold-up* is recovered through periodic maintenance such as filter exchanges and cleaning of process equipment, often in preparation for conducting a *physical inventory*, while other material in *hold-up* may be recovered only during the decommissioning of the plant, such as material plated onto the walls of fixed piping. The IAEA *nuclear material accountancy* principles require that *hold-up* be declared as part of the physical *inventory* and/or *inventory changes* if the related equipment is transferred between *material balance areas (MBAs)*. *Hold-up* is mainly estimated on the basis of plant or equipment specific models; these models are associated with uncertainties larger than those typically observed for accountancy measurements. Therefore, *hold-up* should be minimized as much as possible prior to conducting a *physical inventory*. Developing *hold-up* models may involve dedicated theoretical and experimental studies combined with the use of operational data available through periodic maintenance (e.g. filter exchange, cleaning of process equipment) and of information on the amount of *hold-up* material recovered during the decommissioning of similar plants or equipment.

4.34. Fuel element (or fuel assembly, fuel bundle). A grouping of fuel rods, pins, plates or other *fuel components* held together by spacer grids and other structural components to form a complete fuel unit which is maintained intact during fuel transfer and irradiation operations in a reactor.

4.35. Fuel component. Any of the components of a *fuel element* containing *nuclear material* sealed in metal cladding (e.g. subassemblies and fuel rods, pins or plates), as defined in the *subsidiary arrangements* for *batch* definition and reporting purposes.

4.36. Specified non-nuclear material. For *IAEA safeguards* purposes, non-nuclear material that can be used for the production of *special fissionable material*. Under Article 2.a.(ix) of [540], States are required to provide the IAEA with information on exports and, when requested, with the confirmation of imports of such materials in quantities exceeding the limits indicated in the relevant items of the list of specified equipment and non-nuclear material for the reporting of *imports and exports* according to Article 2.a.(ix) (Annex II to [540]). The non-nuclear material specified includes *nuclear grade graphite* as well as *deuterium and heavy water*. Similar information may be provided to the IAEA by States participating in the *voluntary reporting scheme (VRS)*. *Specified* *non-nuclear material* may also be subject to *IAEA safeguards* under *item-specific safeguards agreements*.

4.37. Nuclear grade graphite. Graphite with a purity level better than five parts per million boron equivalent and with a density greater than 1.5 g/cm^3 for use in a nuclear reactor in quantities exceeding 3×10^4 kg (30 t) for any one recipient country in any period of 12 months. This graphite is listed in Annex II to [540].

Note: The boron equivalent for graphite expresses the quality of the graphite as a neutron moderator in terms of a concentration of naturally occurring boron that corresponds to the same capture level for thermal neutrons as the combined impurities in the graphite.

4.38. Deuterium and heavy water. The *isotope* of hydrogen with mass number 2 (^{2}H) is commonly called deuterium (D). It occurs naturally with an abundance in water of about 150 parts per million. The highly enriched form of water (heavy water, more than 99.5% D_2O) is used as a moderator in *natural uranium* fuelled reactors. Deuterium, heavy water and any other deuterium compound in which the ratio of deuterium to hydrogen atoms exceeds 1:5000 for use in a nuclear reactor in quantities exceeding 200 kg of deuterium atoms for any one recipient country in any period of 12 months are specified in Annex II to [540].

4.39. Zircaloy. An alloy consisting of zirconium and small amounts of other metals (i.e. tin, iron, chromium and nickel). It is used as a cladding material for reactor fuel, especially in light water reactors. Zirconium metal and alloys in the form of tubes or assemblies of tubes, and in quantities exceeding 500 kg in any period of 12 months, especially designed or prepared for use in a nuclear reactor and in which the relation of hafnium to zirconium is less than 1:500 parts by weight are specified in Annex II to [540].

4.40. Nuclear fuel cycle. A system of *nuclear installations* and activities interconnected by streams of *nuclear material*. Such a system may consist of *uranium* mines and concentration (ore processing) plants, *thorium* concentration plants, *conversion plants*, *enrichment (isotope separation) plants*, *fuel fabrication plants*, reactors, spent fuel *reprocessing plants*, and *waste* management installations and associated storage *locations*. The fuel cycle can be ‘closed’ in various ways, for example by the recycling of enriched *uranium* and *plutonium* through thermal reactors (thermal recycle), by the re-enrichment of the *uranium* recovered as a result of spent fuel *reprocessing* or by the use of *plutonium* in a fast breeder reactor.

4.41. Physical model of the nuclear fuel cycle. A detailed overview of the *nuclear fuel cycle* identifying, describing and characterizing technical processes used for converting *source material* to *nuclear material* suitable for use in a nuclear weapon or other nuclear explosive device, and identifying each process in terms of the equipment, *nuclear material* and non-nuclear material involved. The physical model is used by the IAEA, inter alia, for *acquisition path analysis* and for safeguards *State evaluations*.

4.42. Nuclear fuel cycle related research and development activities. As defined in Article 18.a of [540]:

> "[T]hose activities which are specifically related to any process or system development aspect of any of the following:
>
> — conversion of *nuclear material*,
> — enrichment of *nuclear material*,
> — nuclear fuel fabrication,
> — reactors,
> — critical facilities,
> — reprocessing of nuclear fuel,
> — processing (not including repackaging or conditioning not involving the separation of elements, for storage or disposal) of intermediate or high-level waste containing plutonium, high enriched uranium or uranium-233,
>
> but do not include activities related to theoretical or basic scientific research or to research and development on industrial radioisotope applications, medical, hydrological and agricultural applications, health and environmental effects and improved maintenance."

4.43. Facility. As defined in para. 106 of [153]:

> "A reactor, a critical facility, a conversion plant, a fabrication plant, a reprocessing plant, an isotope separation plant or a separate storage installation; or…any location where *nuclear material* in amounts greater than one *effective kilogram* is customarily used".

(See also Article 18.i of [540].) Under [66], two kinds of *facility* are defined (in paras 78 and 81, respectively).

4.44. Location outside facilities (LOF). "[A]ny installation or location, which is not a *facility*, where *nuclear material* is customarily used in amounts of one effective kilogram or less" [540, Article 18.j]. Under para. 49 of [153], a State is required to provide to the IAEA information in respect of *nuclear material* customarily used outside facilities (i.e. at a *LOF*). The corresponding term under para. 66 of [66] is "other locations", which is used in *item-specific safeguards agreements* to refer to installations where *nuclear material* outside principal nuclear facilities is held, for example *source material* not stored in a sealed storage *facility*.

4.45. Item facility. A *facility* where all *nuclear material* is kept in item form and the integrity of the item remains unaltered during its residence at the *facility*. In such cases, *IAEA safeguards* are based on item accountancy procedures (e.g. item counting and identification, non-destructive measurements of *nuclear material*, verification of the continued integrity of the items). Examples of *item facilities* are most reactors and *critical assemblies* (critical facilities), and storage installations for reactor fuel.

4.46. Bulk handling facility. A *facility* where *nuclear material* is held, processed or used in bulk form. Where appropriate, *bulk handling facilities* may be organized into multiple *material balance areas (MBAs)* for safeguards purposes, for example by separating activities relating only to the storage and assembly of discrete fuel items from those involving the storage or processing of bulk material. In a bulk *MBA*, flow and *inventory* values declared by the *facility* operator are verified by the IAEA through independent measurements and observation. Examples of *bulk handling facilities* are *conversion plants*, *enrichment (isotope separation) plants*, *fuel fabrication plants* and spent fuel *reprocessing plants*, and storage facilities for bulk material.

4.47. Facility life cycle. For *IAEA safeguards* purposes, a set of phases over the lifetime of a nuclear *facility*. The *facility life cycle* phases are planned, under construction, in operation, shut-down, closed-down and *decommissioned for safeguards purposes*. Life cycle phases may apply to *locations outside facilities (LOFs)*, as appropriate.

4.48. Shut-down facility (or shut-down LOF). The 'shut-down' status of a *facility* or *location outside facilities (LOF)* involves interrupting the operation of a *facility*. During this phase, the *facility* is not in operation but contains *nuclear material* and could be restarted in a short time. The 'shut-down' status of a *facility* includes maintenance or modification shut-down, extended shut-down and permanent shut-down. The 'permanent shut-down' status of a *facility* begins when operations related to the purpose of the *facility*, as declared in the facility's *design information questionnaire (DIQ)*, have been permanently stopped but the *nuclear material* has not been removed completely. This may include activities related to the decommissioning (e.g. removal or recovery of *nuclear material*, dismantling of equipment, decontamination, cleanout) of the *facility*.

4.49. Closed-down facility (or closed-down LOF). A *facility* or *location outside facilities (LOF)* is in the closed-down phase when operations have been permanently stopped and the *nuclear material* (including *retained waste*) has been removed but the installation or *location* has not been determined as *decommissioned for safeguards purposes*.

4.50. Decommissioned for safeguards purposes. A *facility* or *location outside facilities (LOF)* is considered to be *decommissioned for safeguards purposes* when the IAEA has determined that the operations have been permanently stopped, the *nuclear material* has been removed, and residual structures and equipment essential for use of the *facility* or *LOF* have been removed or rendered inoperable so that the *facility* or *location* is not used to store and can no longer be used to handle, process or utilize *nuclear material*.

4.51. Nuclear installations. As the basis for *categorization of facilities and LOFs (locations outside facilities)* outlined in [361], this term covers *facilities* and *LOFs* under [153] and [540] as well as *facilities* and 'other locations' under [66]. It should be noted that the term 'installation' is also used more broadly, such as in Article 18.b of [540], which refers to installations for the provision or use of essential services, including hot cells for processing irradiated materials not containing *nuclear material*; installations for the treatment, storage and disposal of *waste*; and buildings associated with specified activities identified by a State under Article 2.a.(iv) of [540].

4.52. Categorization of facilities and LOFs. A classification of *facilities* and *locations outside facilities (LOFs)* based on [361] used for IAEA planning and reporting of safeguards implementation. The categories are as follows:

A: *Power reactors*;
B: *Research reactors* and *critical assemblies*;
C: *Conversion plants*;
D: *Fuel fabrication plants*;
E: *Reprocessing plants*;
F: *Enrichment (isotope separation) plants*;
G: *Separate storage facilities*;

H: Other *facilities*;
I: Other locations (*LOFs*);
J: Non-nuclear *facilities* or *locations* (for *item-specific safeguards agreements* only).

4.53. Power reactors. Any device in which a controlled, self-sustaining fission chain reaction can be maintained (i.e. a nuclear reactor) intended to produce electrical power or heat for district heating, industrial or transportation purposes.

4.54. Research reactors. Any nuclear reactor used as a research tool for basic or applied research or for training. Some *research reactors* are used for radioisotope production. The fission heat is generally removed by the coolant at low temperature and is usually not used.

4.55. Critical assemblies. Any assembly used for research and consisting of a configuration of *nuclear material* which, by means of appropriate controls, can sustain a chain reaction. A *critical assembly* is distinguishable from a *research reactor* in that it normally has no special provisions for cooling, is not shielded for high power operation, has a core designed for flexibility of arrangement, and uses fuel in a readily accessible form which is frequently repositioned and varied to investigate various reactor concepts.

4.56. Conversion plants. Any installation for converting the chemical composition of *nuclear material* so as to facilitate its further use or processing, in particular to provide *feed material* for *isotope* separation and/or reactor fuel fabrication. To produce material for *isotope* separation, *natural uranium* ore concentrates or *uranium* oxides from *reprocessing* are converted into uranium hexafluoride (UF_6). To produce material for fuel fabrication, the following conversions are carried out: U_3O_8 or UF_6 to uranium dioxide (UO_2); *uranium* or *plutonium* nitrates to oxides; and *uranium* or *plutonium* oxides to metal. Operations to convert UF_6 to UO_2 normally are performed in conversion sections of *uranium fuel fabrication plants*, while conversions of *uranium* or *plutonium* nitrates to oxides normally are performed in conversion sections of *reprocessing plants* or in a *mixed oxide (MOX) fuel fabrication plant*.

4.57. Fuel fabrication plants. Any installation for manufacturing *fuel elements* or other reactor components containing *nuclear material*, such as targets. The associated conversion, storage and analytical sections of the plant may be included as parts of the fabrication plant.

4.58. Reprocessing plants. Any plant especially designed for or containing essential equipment capable of *reprocessing nuclear material*.

4.59. Enrichment (isotope separation) plants. Any plant especially designed for or containing essential equipment capable of *enrichment* (*isotope* separation) other than analytical instruments.

4.60. Separate storage facilities. Any installation which stores or is specifically designed to store *nuclear material* generated or to be used by another installation.

5. NUCLEAR MATERIAL ACCOUNTANCY

Nuclear material accountancy within the framework of IAEA safeguards begins with the nuclear material accounting activities of facility operators and the State (or regional) system of accounting for and control of nuclear material (SSAC/RSAC), implemented in accordance with the provisions of the safeguards agreement between the IAEA and the State (or group of States). The IAEA applies nuclear material accountancy, complemented by containment and surveillance (C/S) measures, to independently verify the correctness of the accounting information generated by these activities. What follows is a description of safeguards relevant terms related to nuclear material accounting, including relevant verification activities.

5.1. Nuclear material accounting. Activities carried out to establish the quantities of *nuclear material* present within defined areas and the changes in those quantities within defined periods. Elements of *nuclear material accounting* include the establishment of accounting areas; record keeping; *calibration* of *nuclear material measurement systems*; *nuclear material* measurement; preparation and submission of *accounting reports*; and verification of the correctness of the nuclear material accounting.

5.2. Nuclear material accountancy. The practice of *nuclear material accounting* by the operator of the *facility* or *location outside facilities (LOF)* and the *State or regional authority responsible for safeguards implementation* (*SRA*) through the *State (or regional) system of accounting for and control of nuclear material (SSAC/RSAC)*, inter alia, to satisfy the requirements of *safeguards agreements*. The IAEA independently verifies the correctness of the *nuclear material accounting* information in the *facility* records and the reports provided by the *SRA* to the IAEA. Activities involving *nuclear material accountancy* include the following:

Facility level

(a) Dividing operations involving *nuclear material* into *material balance areas (MBAs)* and establishing *material balance periods (MBPs)*;
(b) Maintaining records on the quantities of *nuclear material* held within each *MBA*;
(c) Measuring and recording all transfers of *nuclear material* from one *MBA* to another or changes in the amount of *nuclear material* within *MBAs* due to, for example, *nuclear production* or *nuclear loss*;

(d) Determining periodically the quantities of *nuclear material* present within each *MBA* by conducting a *physical inventory*;
(e) Closing the material balance over the period between two successive *physical inventories* and establishing the *material unaccounted for (MUF)* for that period;
(f) Providing for an accounting and measurement control programme to determine the accuracy and precision of *calibrations* and measurements and the correctness of recorded *source data* and other data;
(g) Testing the *MUF* against its estimated uncertainty (σ_{MUF}) to assess whether all *nuclear material* flows, whenever applicable, *inventory* changes and *inventories* are correctly accounted for.

State/regional authority level

(a) Preparing and submitting *nuclear material accounting reports* to the IAEA, as appropriate;
(b) Ensuring that *nuclear material accounting* procedures and arrangements are adhered to;
(c) Providing for *IAEA inspector* access and coordination arrangements, as necessary, to enable the IAEA to carry out its verification activities;
(d) Verifying the *nuclear material accountancy* performance of *facility* operators, as provided for in the State/regional regulations;
(e) Testing the *MUF* against its estimated uncertainty (σ_{MUF}) to assess whether all *nuclear material* flows and *inventories* are correctly accounted for.

IAEA level

(a) Independently verifying *nuclear material accounting* in *facility* records and State reports by conducting *activities* as provided for in the *safeguards agreements*;
(b) Determining the effectiveness of the *SSAC/RSAC*;
(c) Providing statements to the State on the IAEA's verification activities (see *Statement on Inspection Results (90(a) Statement)* and *Statement on Conclusions (90(b) Statement)*);
(d) Testing the *MUF* against its estimated uncertainty (σ_{MUF}) to assess whether all *nuclear material* flows and *inventories* are correctly accounted for and whether the *MUF* can be explained by legitimate measurement uncertainties to preclude diversion.

5.3. Inventory. The amount of *nuclear material* present at a *facility* or *location outside facilities (LOF)* at any given time.

5.4. Annual throughput. The "amount of *nuclear material* transferred annually out of a *facility* working at nominal capacity" [153, para. 99].

5.5. Throughput. The "rate at which nuclear material is introduced into a facility operating at full capacity" [66, para. 84].

5.6. Near real time accountancy (NRTA). A form of *nuclear material accountancy*, particularly for bulk handling *material balance areas (MBAs)* with large *throughput*, in which detailed *inventory* and *inventory change* data are maintained by the *facility* operator for each item containing *nuclear material* and are made available to the IAEA on a near real time basis. Associated measurement uncertainties of every measurand used to establish the accountancy data are also included in these data. This enables *inventory verification* to be carried out and material balances to be established more frequently than, for example, at the time of the annual *physical inventory* taking by the *facility* operator. When the in-process *inventory* cannot be determined by measurement, *NRTA* requires that an estimate, including its uncertainty, be made of the *inventory* in each piece of equipment containing *nuclear material*, on the basis of documented techniques.

5.7. Material balance area (MBA). As defined in para. 110 of [153]:

> "[A]n area in or outside of a *facility* such that:
>
> (a) The quantity of *nuclear material* in each transfer into or out of each "material balance area" can be determined; and
> (b) The *physical inventory* of *nuclear material* in each "material balance area" can be determined when necessary, in accordance with specified procedures,
>
> in order that the material balance for Agency safeguards purposes can be established."

Paragraph 46(b) of [153] provides that *design information* made available to the IAEA shall be used as follows:

> "To determine *material balance areas* to be used for Agency accounting purposes and to select those *strategic points* which are *key measurement points* and which will be used to determine the *nuclear material* flows and

inventories; in determining such *material balance areas* the Agency shall, inter alia, use the following criteria:

(i) The size of the *material balance area* should be related to the accuracy with which the material balance can be established;
(ii) In determining the *material balance area* advantage should be taken of any opportunity to use containment and surveillance to help ensure the completeness of flow measurements and thereby simplify the application of safeguards and concentrate measurement efforts at *key measurement points*;
(iii) A number of *material balance areas* in use at a *facility* or at distinct sites may be combined into one *material balance area* to be used for Agency accounting purposes when the Agency determines that this is consistent with its verification requirements; and
(iv) If the State so requests, a special *material balance area* around a process step involving commercially sensitive information may be established".

5.8. Catch-all material balance area (CAM). A *material balance area (MBA)* that covers multiple *locations outside facilities (LOFs)* in a State for *nuclear material accounting* purposes. *LOFs* covered by such an *MBA* are often identified as *key measurement points (KMPs)* within the *CAM*.

5.9. Strategic point. As defined in para. 116 of [153]:

"[A] location selected during examination of design information where, under normal conditions and when combined with the information from all "strategic points" taken together, the information necessary and sufficient for the implementation of safeguards measures is obtained and verified; a "strategic point" may include any location where key measurements related to material balance accountancy are made and where containment and surveillance measures are executed."

5.10. Key measurement point (KMP). As defined in para. 108 of [153]:

"[A] location where *nuclear material* appears in such a form that it may be measured to determine material flow or inventory. "Key measurement points" thus include, but are not limited to, the inputs and outputs (including measured discards) and storages in *material balance areas*."

5.11. Batch. A portion of *nuclear material* for which the composition and quantity are defined by a single set of specifications or measurements. One *batch* may be composed of one item or a number of separate items, or may be in bulk form as a whole.

5.12. Batch data. As defined in para. 101 of [153]:

> "[T]he total weight of each element of *nuclear material* and, in the case of plutonium and uranium, the isotopic composition when appropriate. The units of account shall be as follows:
>
> (a) Grams of contained plutonium;
> (b) Grams of total uranium and grams of contained uranium-235 plus uranium-233 for uranium enriched in these isotopes; and
> (c) Kilograms of contained thorium, natural uranium or depleted uranium.
>
> For reporting purposes the weights of individual items in the *batch* shall be added together before rounding to the nearest unit."

5.13. Source data. As defined in para. 115 of [153]:

> "[T]hose data, recorded during measurement or calibration or used to derive empirical relationships, which identify *nuclear material* and provide *batch data.* "Source data" may include, for example, weight of compounds, conversion factors to determine weight of element, specific gravity, element concentration, isotopic ratios, relationship between volume and manometer readings and relationship between plutonium produced and power generated."

5.14. Identity data (or identification data). Those data needed to uniquely characterize an item, *batch* or *stratum* of *nuclear material*. Examples are a *material balance area (MBA)*, *nuclear material type*, *batch* identification, *material description*, and type and date of an *inventory change*. Note that a batch identifier (batch ID) is unique within the *MBA*. Two *batches* in an *MBA* cannot have the same batch ID at the same time.

5.15. Unified uranium. A category of *uranium*, used for *nuclear material accounting* and reporting purposes under *INFCIRC/153-type safeguards agreements*, where all *uranium* (i.e. natural, depleted and enriched) is included in a single (unified) account. The *material balance area (MBA)* and the *State (or regional) system for accounting for and control of nuclear material*

(SSAC/RSAC) must account for and report the grams of total *uranium* and grams of contained ^{235}U plus ^{233}U regardless of the *enrichment* for the *batch* of *nuclear material*. The use of a unified uranium account is a point of negotiation in the *subsidiary arrangements*.

5.16. Material description code (MDC). Description of a *nuclear material batch* in an *accounting report* under the relevant *safeguards agreement*. For example, *nuclear material batches* are described by four parameters in *Code 10*: physical form; chemical composition; *containment* or type of container; and irradiation status and quality.

5.17. Inventory change. "[A]n increase or decrease, in terms of *batches*, of *nuclear material* in a *material balance area*" [153, para. 107]. Such a change may involve one of the following:

(a) Increases: *Import, domestic receipt, nuclear production, accidental gain*, retransfer from *retained waste* and *de-exemption* of *nuclear material* from *IAEA safeguards*.
(b) Decreases: *Export, domestic shipment, nuclear loss, other loss, measured discard,* transfer to *retained waste, exemption* of *nuclear material* from *IAEA safeguards* and *termination of IAEA safeguards* on *nuclear material* transferred to non-nuclear use.
(c) Rebatching: Changes in the structure or name of a *batch* are referred to as *rebatching* and are reported in *inventory change reports (ICRs)*.

Inventory changes are associated with a two-character code, called the inventory change code. The codes are defined in model subsidiary arrangement *Code 10*. The most common inventory change codes are defined below in terms 5.18–5.30.

5.18. Import and export (inventory change codes: RF, SF). International transfer of *nuclear material* subject to *IAEA safeguards* into or out of a State. The responsibility for material which is transferred internationally is defined in para. 91 of [153], and the requirements for notification of the IAEA by the responsible States are provided in paras 63, 92–96 and 107 of [153].

5.19. Domestic receipt (inventory change codes: RD, RN, RS). According to para. 107 of [153], the receipt from other *material balance areas (MBAs)* within a State, receipt from a non-safeguarded (non-peaceful) activity or receipt at the *starting point of safeguards (under a comprehensive safeguards agreement)*.

5.20. Nuclear production (inventory change code: NP). According to para. 107 of [153], the generation of *special fissionable material* through irradiation of *fertile material* in a reactor. *Nuclear production* of *fissionable material* is also applicable to an accelerator.

5.21. Accidental gain (inventory change code: GA). Unforeseen *nuclear material* that is present in a *material balance area (MBA)*, except when detected in the course of a *physical inventory* taking by the *facility* operator.

5.22. De-exemption (inventory change codes: DU, DQ). "[R]eapplication of safeguards on *nuclear material* previously exempted therefrom on account of its use or quantity" [153, para. 107].

5.23. Retained waste (inventory change code: TW). "*[N]uclear material* generated from processing or from an operational accident, which is deemed to be unrecoverable for the time being but which is stored" [153, para. 107]. The actual *inventory change* used in *accounting records* and reports is termed 'transfer to retained waste'. *Nuclear material* transferred to *retained waste* is stored at the *material balance area (MBA)* and continues to be subject to *IAEA safeguards* but is not included in the *inventory* of the *MBA*. See also *waste.*

5.24. Domestic shipment (inventory change codes: SD, SN). "[S]hipments to other *material balance areas* or shipments for a non-safeguarded (non-peaceful) activity" within a State [153, para. 107].

5.25. Nuclear loss (inventory change code: LN). "[L]oss of *nuclear material* due to its transformation into other element(s) or isotope(s) as a result of nuclear reactions" [153, para. 107]. Nuclear loss also includes burnup of *nuclear material* in a reactor and decay (e.g. of ^{241}Pu) during storage.

5.26. Measured discard (inventory change code: LD). "*[N]uclear material* which has been measured, or estimated on the basis of measurements, and disposed of in such a way that it is not suitable for further nuclear use" [153, para. 107].

5.27. Exemption (of nuclear material) (inventory change codes: EU, EQ). "[E]xemption of *nuclear material* from safeguards on account of its use or quantity" [153, para. 107].

5.28. Termination of IAEA safeguards (inventory change code: TU). Termination of IAEA safeguards on *nuclear material* pursuant to para. 35 of [153].

5.29. Other loss (inventory change code: LA). "[F]or example, accidental loss (that is, irretrievable and inadvertent loss of *nuclear material* as the result of an operational accident) or theft" [153, para. 107].

5.30. Rebatching (inventory change codes: RM, RP). *Batch* follow-up in the *material balance area (MBA)* (up to specified points or over the *MBA* as a whole), which may be performed by reporting the decreases and corresponding increases in the contents of specified *batches* directly and without associated changes in the total *inventory* for the *MBA*. These decreases and matching increases in given *batches* should be reported simultaneously in separate entries, as if they were *inventory changes*. *Batch* follow-up codes detail changes, which can include, but are not limited to, structural changes as well as *batch* names. This procedure may also be used whenever a *batch* ceases to exist (i.e. all material is transferred into another *batch*) as well as when a *batch* is simply renamed.

5.31. Adjustment. "[A]n entry into an accounting record or a report showing a *shipper/receiver difference* or *material unaccounted for*" [153, para. 98].

5.32. Correction. As defined in para. 103 of [153]:

> "[A]n entry into an accounting record or a report to rectify an identified mistake or to reflect an improved measurement of a quantity previously entered into the record or report. Each correction must identify the [prior] entry to which it pertains."

5.33. Accounting records. A set of data kept at each *facility* or *location outside facilities (LOF)* showing the quantity of each type of *nuclear material* present, its *location* within the *facility* (or *LOF*) and any changes affecting it. Accounting records, such as a *general ledger*, contain the following information:

> "[I]n respect of each *material balance area*:
>
> (a) All *inventory changes*, so as to permit a determination of the *book inventory* at any time;
> (b) All measurement results that are used for determination of the *physical inventory*; and
> (c) All adjustments and *corrections* that have been made in respect of *inventory changes*, *book inventories* and *physical inventories*" [153, para. 56].

In addition, “for all *inventory changes* and *physical inventories* the records shall show, in respect of each *batch* of *nuclear material*: material identification, *batch* data and source data” [153, para. 57].

5.34. Operating records. A set of data kept at each *facility* on the operation of the *facility* in connection with the use or handling of *nuclear material*. The *operating records* of a reactor show, for example, the integrated thermal power produced by the reactor for a given period and the associated data of the reactor operation for that period as needed to determine the *nuclear production* and *nuclear loss*, and the *location* of each *fuel element* at any time. *Operating records* contain the following information:

“[I]n respect of each *material balance area*:

(a) Those operating data which are used to establish changes in the quantities and composition of *nuclear material*;
(b) The data obtained from the calibration of tanks and instruments and from sampling and analyses, the procedures to control the quality of measurements and the derived estimates of random and systematic error;
(c) A description of the sequence of the actions taken in preparing for, and in taking, a *physical inventory*, in order to ensure that it is correct and complete; and
(d) A description of the actions taken in order to ascertain the cause and magnitude of any accidental or unmeasured loss that might occur” [153, para. 58].

5.35. Supporting document. A record containing *identity data*, *source data* and *batch data* for each accounting transaction, such as shipping documents, weight (volume) records, laboratory records, charge and/or discharge records and power production records.

5.36. Measurement system. Procedures, personnel and equipment, as well as standards, certifications and *calibrations*, used for determining the quantities of *nuclear material* received, produced, shipped, lost or otherwise added to or removed from *inventory*, and the quantities on *inventory*, as provided for in paras 32(a) and 32(b) of [153]. This system should provide for, inter alia, the following:

(a) Identification of *key measurement points (KMPs)*, accountability areas, *inventory locations* and the characteristics of the *nuclear material* to be measured;
(b) Specification of the measurement performance desired;
(c) Specification of the measurement techniques employed;
(d) Specifications for measurement equipment;
(e) Equipment maintenance provisions and procedures;
(f) Operator's qualifications and provisions for training;
(g) *Calibration* standards and procedures;
(h) Routine measurement and data analysis procedures;
(i) Procedures for controlling measurement quality and maintaining performance at the desired level;
(j) Procedures for generating *sample plans* and obtaining *representative samples*;
(k) Procedures for combining measurements and *measurement uncertainties* to calculate *material unaccounted for (MUF)* and *MUF* uncertainty (σ_{MUF});
(l) Evaluation of precision and accuracy of measurements and the estimation of *measurement uncertainty* (see para. 32(b) of [153]).

Paragraph 55 of [153] provides "that the system of measurements on which the [facility] records used for the preparation of reports are based shall either conform to the latest international standards or be equivalent in quality to such standards". Such standards include the *international standards of accountancy (ISA)* and *international target values (ITVs)*.

5.37. Metrological traceability. As defined by the Joint Committee for Guides in Metrology (bold omitted): "[P]roperty of a measurement result whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty"[3].

5.38. International standards of accountancy (ISA). Values of the relative *measurement uncertainty* δ_E expected for closing a material balance. These values, which were established in the 1970s on the basis of operating experience at the various types of *bulk handing facility*, are considered to be achievable under the conditions of normal operation. Table 3 shows δ_E (expressed as a *relative standard deviation (RSD)*) for different types of *bulk handling facility*.

[3] JOINT COMMITTEE FOR GUIDES IN METROLOGY, International Vocabulary of Metrology: Basic and General Concepts and Associated Terms (VIM), 3rd edn, 2008 Version with Minor Corrections, JCGM 200:2012, JCGM, Sèvres (2012).

TABLE 3. EXPECTED MEASUREMENT UNCERTAINTY δ_E (RELATIVE STANDARD DEVIATION) ASSOCIATED WITH CLOSING A MATERIAL BALANCE

Bulk handling facility type	δ_E
Uranium enrichment	0.002
Uranium fabrication	0.003
Plutonium fabrication	0.005
Uranium reprocessing	0.008
Plutonium reprocessing	0.010
Separate scrap storage	0.04
Separate waste storage	0.25

5.39. International target values (ITVs). Values of random and systematic *measurement uncertainty* components which should be achievable under regular conditions for typical industrial laboratories and safeguards verification measurements for *destructive analysis (DA)*, *non-destructive assay (NDA)* and *bulk measurements* (weight, volume) performed on *nuclear material*. They are expressed as *relative standard deviations (RSDs)* and are values for uncertainties associated with a single determination result. For example, this may be the result reported by one laboratory on one sample (independent of the analytical scheme applied internally in the laboratory) or the result of an *NDA* measurement performed on a single item. The values are based on actual practical measurement experiences and are intended to be used as a reference for routinely achievable measurement quality by *facility* operators, *State (or regional) systems for accounting for and control of nuclear material (SSAC/RSACs)* and the IAEA. The values are regularly updated to address changes in measurement capabilities, methods and techniques and their application to *nuclear material*.

5.40. Stratum/strata. A grouping of items and/or *batches* having similar physical characteristics (e.g. ^{235}U *enrichment*, *plutonium* isotopic composition, container size, homogeneity) and chemical characteristics (e.g. composition, additives) and for which the operator declared values are based on a common accounting method. *Strata* are established to enable effective verification of these items and/or *batches* (e.g. effective statistical *sampling plans*, effective measurements) and to perform effective *material balance evaluation*. The desired end result of stratification is that the items and/or *batches* in a particular *stratum* are as similar as possible with respect to the physical and chemical characteristics relevant for verification purposes. Each *stratum* is given a code with a maximum of five characters (e.g. SF for spent fuel, FF for fresh fuel).

5.41. Rounding adjustment. Used to account for differences between summarized *material balance report (MBR)* values and the sum of amounts in the corresponding entries in *inventory change reports (ICRs)* or *physical inventory listings (PILs)*. Each component of the *MBR* can have a rounding adjustment denoted by 'RAxx', where xx is the *MBR* component.

5.42. Source documents. The original documents containing the information used by the operator in its accountancy system (records), including the documents containing the *source data* (e.g. the delivery receipts signed by the shipper/receiver *supporting documents*).

5.43. Book inventory (BI). "[T]he algebraic sum of the most recent *physical inventory* of that *material balance area* and of all *inventory changes* [increases/decreases] that have occurred since that *physical inventory* was taken" [153, para. 102]. The *BI* value is typically maintained in an *accounting record* known as the *general ledger*.

5.44. Physical inventory. "[T]he sum of all the measured or derived estimates of *batch* quantities of *nuclear material* on hand at a given time within a *material balance area*, obtained in accordance with specified procedures" [153, para. 113]. The beginning and ending *physical inventories* of a *material balance period (MBP)* are determined by the *facility* operator as a result of a *physical inventory* taking and are reported to the IAEA in the *physical inventory listing (PIL)*. The *physical inventory* is verified by the IAEA during a *physical inventory verification (PIV)* inspection. The ending *physical inventory* for an *MBP* is also the beginning *physical inventory* for the next *MBP*.

5.45. Material balance component. The combination of all *strata* in one term of the material balance equation (i.e. the *material unaccounted for (MUF)* equation); for example, arriving UF_6 cylinders, UO_2 powder in drums and any other increases are combined in the *inventory* of the *material balance area (MBA)*.

5.46. Material unaccounted for (MUF). "[T]he difference between *book inventory* and *physical inventory*" [153, para. 111]. This is calculated for a *material balance area (MBA)* over a *material balance period (MBP)* using the *material balance equation*, commonly written as:

$$\text{MUF} = (\text{PB} + X - Y) - \text{PE}$$

where the four *material balance components* are as follows:

PB	is the beginning *physical inventory*;
X	is the sum of increases to *inventory*;
Y	is the sum of decreases from *inventory*;
and PE	is the ending *physical inventory*.

Because the *book inventory (BI)* is the algebraic sum of PB, X and Y, MUF can be described as the difference between the ending *BI* and the ending *physical inventory*. For item *MBAs*, MUF should be zero; a non-zero MUF is an indication of a problem (e.g. accounting mistakes) which should be investigated. For bulk handling *MBAs*, a non-zero MUF is expected because of *measurement uncertainty* and the nature of processing of *nuclear material* in bulk form (a negative MUF is a 'gain' of material). The operator's *measurement uncertainties* associated with the *strata* in each of the four *material balance components* are combined with the material quantities to determine the uncertainty of the material balance, also referred to as σ_{MUF}.

5.47. Cumulative material unaccounted for (CuMUF). The algebraic sum of the *material unaccounted for (MUF)* for a *material balance area (MBA)* over several *material balance periods (MBPs)*.

5.48. Shipper/receiver difference (SRD) (inventory change code: DI). "[T]he difference between the quantity of *nuclear material* in a *batch* as stated by the shipping *material balance area* and as measured at the receiving *material balance area*" (para. 114 [153]). The *SRD* can be positive or negative (a positive *SRD* is a 'loss' of material). For example, when the receiver declares the shipper value to be 100 kg in a UO_2 drum and the receiver declares a measurement of 95 kg, the *SRD* is 100 – 95 = 5 kg.

5.49. Cumulative shipper/receiver difference. The algebraic sum of the *shipper/receiver differences (SRDs)* for a *material balance area (MBA)* over several *material balance periods (MBPs)*.

5.50. Material balance period (MBP). The time between two consecutive *physical inventory* takings as reflected in the State's *material balance* *report* (*MBR)*. Under some *item-specific safeguards agreements*, the term is used to refer to what more accurately should be called the book balance period, since the beginning and the ending dates of the period are not linked to *physical inventory* takings or to the inspection dates.

5.51. Examination of records. A set of IAEA *inspection activities* which under [153] is referred to as an *examination of records* and under [66] as auditing activities. *Facility* records are examined with the intent of establishing a correct set of data upon which to base the verification of the flow and the *inventory* of *nuclear material*. *Examination of records* consists of all or some of the following activities: examination of *accounting records*; examination of *operating records*; reconciliation of accounting with *operating records*; *updating of the book inventory*; and comparison of *facility* records with State reports and/or notifications to the IAEA.

5.52. Updating of the book inventory. An IAEA *inspection activity* which requires that the inspector establish a *book inventory (BI)* of a *material balance area (MBA)*; that is, the amount of *nuclear material* that should be present in the *MBA*. The updating is based on the *BI* value established during the previous *inspection* and uses *facility* records and *supporting documents* covering the intervening period. The *BI* value is the basis for verification of the *inventory* of *nuclear material* actually present in the *MBA* as of the date when the *BI* was updated.

5.53. Inventory change verification. An IAEA *inspection activity* intended to verify a recorded increase or decrease of the *inventory* of *nuclear material* in a *material balance area (MBA)*. Verification of *inventory changes*, as components of the material balance, is essential for the IAEA's verification of the overall material balance and the determination of the *inspector's estimate of material unaccounted for (IMUF)*. The verification is based on the *inventory change* data in the *facility* records and *supporting documents* and involves the use of *IAEA accountancy verification methods*.

5.54. Inventory verification. An IAEA *inspection activity* intended to confirm that the amount of *nuclear material* actually present at a given time within a *material balance area (MBA)* is in agreement with the operator's recorded *book inventory (BI)* of *nuclear material* for the *MBA*. Under [153], the verification of *inventory* is performed at inventory *key measurement points (KMPs)*. There are two types of inventory verification: *physical inventory verification (PIV)* and *interim inventory verification (IIV)*.

5.55. List of inventory items (LII) (or itemized inventory listing (IIL)). A set of records used by operators to record the itemized *inventory*, such as in *material balance areas (MBAs)* and at *key measurement points (KMPs)*.

5.56. Physical inventory verification (PIV). An IAEA *inspection activity* that closely follows, or coincides with, the *physical inventory* taking which closes the *material balance period (MBP)*. The basis for a *PIV* is the *list of inventory items (IIL)* prepared by the operator. The data are reconciled with the *physical inventory listing (PIL)* reports submitted by the State to the IAEA.

5.57. Physical inventory verification equivalent. A *physical inventory verification (PIV) inspection* intended after a *physical inventory* taking when a nuclear reactor remains in operation and is not shut down for periodic refuelling in a given calendar year. As a result of changes in fuel design and reactor operation, facility owners are increasingly operating reactors for extended periods between refuelling (e.g. 18 months). Therefore, a *physical inventory verification equivalent inspection* is a *PIV* which does not involve the verification of the *nuclear material* in the reactor core which has been under *seal* since the previous *PIV*. The *inspection* verification and reporting for a closed core *PIV* are based on the itemized inventory list (LII) provided by the *facility* operator, which is derived from the previous core loading configuration. The core contents (core fuel items) will be verified by *non-destructive assay (NDA)* and visual observation at the next core opening.

5.58. Interim inventory verification (IIV). An IAEA *inspection activity* that takes place within a *material balance period (MBP)*. Such verification is for timely detection or, for example, for reestablishment of the *inventory* of *nuclear material*.

5.59. Verification of nuclear material flows within an MBA. An IAEA *inspection activity* carried out at *strategic points* other than *key measurement points (KMPs)* or at *strategic points* for *containment* and/or *surveillance* within a *material balance area (MBA)*. Examples include verification of the transfer of fresh and spent fuel assemblies into and out of the core of a reactor and sampling of pellets at the rod loading stations of *fuel fabrication plants*.

5.60. Verification of the operator's measurement system. A verification activity carried out to enable the IAEA to assess the quality of the operator's *measurement system* so as to be able to independently estimate its accuracy and precision, and to compare its accuracy and precision against *international target values (ITVs)*. Examples of this verification activity include observation of the operator's measurement procedures, including procedures to calibrate the operator's measuring equipment; assessment of the operator's measurement of standards provided by the IAEA; and the taking of samples for *destructive analysis (DA)* to assess the quality of the operator's analytical methods.

5.61. IAEA accountancy verification methods. Methods and techniques used by the IAEA to independently verify *nuclear material accounting* information. Commonly used methods include identification and weighing of *nuclear material*, volume determination, sampling and analysis, *non-destructive assay (NDA)* (e.g. for bias, partial or gross *defects*), *criticality check* for verification, item counting, spent fuel *inventory* check and *seal* verification. Each method is identified by a single letter code according to IAEA procedures. See also Section 6.

5.62. Code 10. Part of the *subsidiary arrangements* (General Part) that contains the reporting formats for *nuclear material accounting reports* to be used by a State. *Code 10* defines the data fields, formats, structure and content of *nuclear material accounting reports*. It is a primary reference when addressing *nuclear material accounting* and reporting issues. For example, the *material description code (MDC)* comprises four characters describing the physical form, the chemical form, the *containment*, and irradiation status and quality. As an example, 'BQ2F' stands for complete *fuel elements* for a given reactor system (e.g. Assemblies or bundles), dioxide, discrete fuel units and components, in shipping or storage containers, fresh *fuel elements* or *fuel assemblies*. These types of detail are specified in *Code 10*.

5.63. General ledger. The master system of records describing *inventory changes* in a safeguarded *facility*. While the term is not referred to explicitly in *safeguards agreements*, it is generally understood to include information required under the relevant *safeguards agreement* in respect of account records. For example, paras 56 and 57 of [153] provide that, for all *inventory changes* and *physical inventories*, the *accounting records* shall show material identification, *batch data* and *source data*; that records shall account for *uranium*, *thorium* and *plutonium* separately in each *batch* of *nuclear material*; and that the date of the *inventory change* and, when appropriate, the originating *material balance area (MBA)* and the receiving *MBA* or the recipient, shall be indicated for each *inventory change*.

A *general ledger* functions as one of the bases at the *facility* level of the national system of accounting for and control of *nuclear material*, as referred to in para. 7 of [153], and permits a determination of the *book inventory (BI)* at any time.

5.64. Nuclear material control. The State's system of accounting for and control of all *nuclear material* subject to safeguards under the relevant agreement includes all the measures to control and be able to report at any time the actual amounts and movements of *nuclear materials* for the State and each of its *material balance areas (MBAs)*.

Nuclear material control measures are included in the safeguards State's system to ensure that the *nuclear material* in the country will remain in peaceful activities and that the State itself is capable of timely detection of *diversion of nuclear material*. For example, the legal establishment of a licensing, enforcement and inspection system within the country constitutes a measure of control of *nuclear material*.

5.65. Element code. A single-letter code used in *accounting reports* — for example, under an *INFCIRC/153-type safeguards agreement* — to characterize the relevant chemical element (i.e. *nuclear material*). For *IAEA safeguards*, the element name or code of the quantities specified in the subsequent columns should be given. The codes in Table 4 should be used, unless otherwise indicated in the relevant *subsidiary arrangements* and/or *facility/location outside facilities (LOF)* attachment.

If in a given *material balance area (MBA)* the code for *unified uranium* ('U') is used, it replaces codes 'D', 'N' and 'E', which consequently may not be used (for more details, see *Code 10*).

TABLE 4. ELEMENT CODES USED IN ACCOUNTING REPORTS

Keyword	Code
Depleted uranium	D
Natural uranium	N
Enriched *uranium*	E
Uranium, unified	U
Plutonium	P
Thorium	T

5.66. Category change procedure. Various categories of *uranium* which are blended and accordingly combined into a single category, or where *uranium* had its category changed as a result of blending, *enrichment*, *depletion* or burnup. The associated codes to be used are as follows:

- — EN: Enriched *uranium* to *Natural uranium*;
- — ED: Enriched *uranium* to *Depleted uranium*;
- — NE: *Natural uranium* to Enriched *uranium*;
- — DN: *Depleted uranium* to *Natural uranium*;
- — DE: *Depleted uranium* to Enriched *uranium*;
- — ND: *Natural uranium* to *Depleted uranium*.

For *material balance reports (MBRs)*, the consolidated category changes should be reported as a decrease for the material balance pertaining to the category in which the *uranium* had its category changed, and as an increase for the material balance pertaining to the resulting *uranium* category. The code appropriate for the category change should be used in *inventory change reports (ICRs),* and the 'element', 'unit' and 'weight of fissile isotopes' will be reported pursuant to the category covered in the *MBR*. There are no category changes for *uranium* reported as unified (for more details, see *Code 10*).

5.67. Measurement basis. This information serves to indicate whether or not the reported *batch data* are based on measurements made in the *material balance area (MBA)* and, if not, what they are based on. One of the keywords or codes in Table 5 should be used.

Whenever at a *key measurement point (KMP)* only certain — but not all — quantity parameters are measured (e.g. weight of total *uranium* in a *batch*), whereas other parameters are accepted at face value (e.g. *enrichment* as stated by the shipper), the keyword 'measured' is to be applied (for more details, see *Code 10*).

5.68. Transit matching. An activity performed by the IAEA to match receipts domestic and foreign from the receiving *material balance area (MBA)* with shipments domestic and foreign from the shipping *MBA* or State and, respectively, to match shipments domestic and foreign from the shipping *MBA* with respective domestic and foreign receipts from the receiving *MBA* or State. A semi-annual statement is sent to the Member States to inform them of the results of this activity and to request any relevant follow-up information as needed.

TABLE 5. KEYWORDS OR CODES TO DESCRIBE THE MEASUREMENT BASIS

Keyword	Code	Explanation
Measured	M	The *batch data* are based on measurements made at the *material balance area (MBA)*, including *key measurement points (KMPs)* on its boundary.
Measured elsewhere	N	The *batch data* are based on measurements made at another *MBA*.
Tagged	T	The *batch data* are based on measurements previously made at the same *MBA* and have been reported for that *MBA* in an *inventory change report (ICR)* or *physical inventory listing (PIL)* and the measurements have not been repeated.
Labelled	L	The *batch data* are based on measurements previously made at another *MBA* and have been reported for the present *MBA* in an *ICR* or *PIL* without remeasurement.

6. NUCLEAR MATERIAL MEASUREMENT TECHNIQUES AND EQUIPMENT

Nuclear material verification depends on techniques and equipment for sampling, measurement and analysis of nuclear material. Physical standards are required for the calibration of measurement equipment and to provide a basis for determining the accuracy of measurements.

6.1. Calibration. A set of actions used when setting up the *measurement system* and during periodic validation of the performance of an instrument or *measurement system* to quantify the relation between instrument output and the value of standards considered as representing the true measured values. Through *calibration*, measurement biases can be minimized and the precision of an instrument or *measurement system* can be estimated. *Calibration* is performed using certified *reference materials* or standards. The result of the *calibration* (or *calibrations*) is recorded in a document called a *calibration* certificate and is sometimes expressed as a *calibration* factor or a set of *calibration* parameters, for example in the form of a *calibration* curve. The *calibration* process should include an estimate of the associated random and systematic components of *measurement error* variances.

6.2. Reference material. A material, sufficiently homogeneous and stable with reference to specified properties, which has been established to be fit for its intended use in measurement or in examination of nominal properties. A 'certified *reference material*' is *reference material* accompanied by documentation issued by an authoritative body which provides one or more specified property values with associated uncertainties and traceabilities. Certified *reference materials* include the following:

- Primary (measurement) standards, which are of high metrological quality and have an acceptable value without reference to other standards;
- Secondary (measurement) standards, which are established through *calibration* with respect to a primary standard;
- Derived/working standards, which have a value assigned by comparison with a primary or secondary standard of the same quantity.

6.3. Bulk measurement. Determination of the mass of material subject to *IAEA safeguards* verification, such as solid materials or solutions in containers and solutions or powders in tanks. For material where only volume measurement is possible, the mass can be calculated by using the density of the material measured, to the extent possible, in a manner that is representative (i.e. *representative sample*) at the time of the *bulk measurement*. In the context of *IAEA safeguards*, a *bulk measurement* can be combined with sampling, which also permits the precise determination of the chemical composition of the material as well as the concentration of safeguards relevant *isotopes*.

6.4. Matrix. The components of a sample other than the component being measured. In some cases, the *matrix* material has a considerable influence on the response of the measuring equipment, and therefore on the measurement results. These are called '*matrix* effects'. For example, the presence of hydrogen or fluorine in a *matrix* can have an impact on results obtained through the use of a *neutron coincidence counting* technique.

6.5. Material sample. A part or quantity selected from a larger group of items or quantity of material for inspection or analysis. The sample should be representative, meaning it is typical with respect to certain specified characteristics of the population or material from which the sample is collected. A *material sample* is a small quantity of material taken from one item or container for measurement. A *composite sample* is obtained by taking several quantities from one or more containers, mixing them together and then selecting one or more aliquots for measurement.

6.6. Representative sample. A sample which is typical with respect to certain specified characteristics of the population or material from which the sample is collected. For example, in *swipe sampling*, selecting only large units from a mixed population of large and small units would give a sample that is typical of the large units; however, it would be a non-representative sample of the mixed population. To obtain a *representative sample* of this mixed population, the population should first be divided into two separate groups (*strata*) of large and small items and these groups should then be sampled separately. In material sampling, homogenization of material (e.g. solutions) prior to sampling may be required to obtain a *representative sample*.

6.7. Calorimetry. A method used for determining the amount of *plutonium* in a sample by measuring its thermal power emission and converting this measurement to *plutonium* quantity by using the abundances of *plutonium isotopes* and of *americium* measured separately, and standard values of the thermal emission rates of the *plutonium isotopes* and *americium*.

6.8. Assay. A measurement which establishes the quantity and composition of *nuclear material* present in the items being measured; the term is also used as a synonym for ‘analysis’. There are two methods used: *destructive analysis (DA)* and *non-destructive assay (NDA)*.

6.9. Destructive analysis (DA). Determination of *nuclear material* content and, if required, of the isotopic composition of chemical elements present in the sample. *DA* normally involves destruction of the physical form of the sample. In the context of *IAEA safeguards*, determination of the *nuclear material* content of an item sampled usually involves the following:

— Measurement of the mass of the item;
— The taking of a *representative sample*;
— Sample conditioning (if necessary) prior to shipment to the IAEA *Safeguards Analytical Laboratories (SAL)* for analysis or to the *location* of on-site analysis;
— Processing of the sample to the chemical state required for the analysis (e.g. dissolution in nitric acid);
— Determination of the mass fraction (also called concentration) of the *nuclear material* (i.e. *uranium*, *plutonium* or *thorium*) present in the sample (i.e. elemental analysis) using, inter alia, techniques described in terms 6.10–6.18;
— Determination of the isotopic abundance ratios of *uranium* or *plutonium isotopes* (i.e. isotopic analysis) using, inter alia, techniques described in terms 6.10–6.18.

6.10. Chemical titration. A method of chemical analysis whereby an unknown amount of an element or compound is reacted with an exactly measured amount of a reagent of known composition, leading to the completion or characteristic end-point of a well known stoichiometric chemical reaction. Titration methods are designated according to, inter alia, the mode of detection of the end-point (e.g. potentiometric and spectrophotometric titration). The IAEA’s Nuclear Material Laboratory uses potentiometric titration for the determination of *uranium* content in 40 mg size *uranium* aliquots of unirradiated *nuclear material* (see *material type*).

6.11. Controlled potential coulometry. An electrochemical method for measurement of the mass fraction, whereby the element to be analysed is selectively oxidized or reduced at a metallic electrode maintained at a controlled potential. The number of electrons (coulombs) used in the electrolysis is measured. This is a primary method to determine the *plutonium* mass fraction and is used at the IAEA’s Nuclear Material Laboratory to determine *plutonium*, especially for *reference materials*.

6.12. Gravimetric analysis. A technique whereby the element to be analysed is quantitatively separated and transformed into a well defined and very pure chemical compound which is accurately weighed and related to the stoichiometric quantity of the element to be analysed in the compound. For example, at the IAEA's Nuclear Material Laboratory, ignition gravimetry is used for determining *uranium* concentrations in oxides by converting them to stoichiometric U_3O_8 for *uranium*.

6.13. Isotope dilution mass spectrometry (IDMS). A quantitative mass spectrometry technique for the measurement of the total *uranium* or *plutonium* quantities in a sample in which an isotopically enriched tracer (e.g. ^{233}U for *uranium*, ^{242}Pu or ^{244}Pu for *plutonium*) is used as a surrogate internal standard. The tracer *isotope* should be normally absent or of low abundance in the sample. The amount of the analyte is determined by measuring the abundances of all *isotopes* present in the sample with a mass spectrometer and then determining the unknown by considering the quantity of tracer and the isotopic ratios observed in an unspiked sample, in the tracer and in the spiked sample.

6.14. K-edge densitometry. A technique for measuring the *uranium* and *plutonium* mass fraction/concentration in solutions by determining the ratio of the transmission of photons whose energies closely bracket the K-electron absorption edge of the *uranium* or *plutonium.* Hybrid instruments combining *K-edge densitometry* and *X ray fluorescence (XRF)* analysis are used for determining *uranium* and *plutonium* mass fraction/concentrations in mixed solutions, including highly radioactive spent fuel solutions.

6.15. Mass spectrometry. An isotopic analysis technique whereby small quantities of a sample are ionized, focused into a beam and passed through a mass analyser where the ions are separated according to their mass-to-charge ratios, thereby producing a mass spectrum on a fixed detector or detector array. The intensities of the deflected beams of ions of different masses are measured to yield the isotopic ratios.

6.16. Gas source mass spectrometry (GSMS). A mass spectrometric technique in which gaseous samples (e.g. uranium hexafluoride (UF_6)) are introduced and ionized in the ion source of the mass spectrometer and multiple detectors are used to simultaneously collect ions of different masses and provide measurements of *uranium* isotopic ratios with high precision.

6.17. Thermal ionization mass spectrometry (TIMS). A technique (also called surface ionization mass spectrometry) in which picogram to microgram quantities of a sample are deposited on a metallic filament that is then heated to 1600–2000ºC in a high vacuum. The analyte is ionized through contact with a high temperature surface, and the ions produced are analysed in a mass spectrometer to yield isotopic ratios. Highly accurate results require that sample *cross-contamination* be minimized.

6.18. Alpha spectrometry. Measurement of the energy spectrum of alpha particles to determine the abundance of alpha emitting *isotopes* such as ^{238}Pu and ^{244}Cm in the material measured. At the IAEA's Nuclear Material Laboratory, the technique is used in parallel with *isotope dilution mass spectrometry (IDMS)* for the analysis of *plutonium* and spent fuel samples.

6.19. Non-destructive assay (NDA). A measurement technique applied to *nuclear material* and other items of safeguards interest to confirm their isotopic composition and quantity without destroying the items. *NDA* measurements can be conducted in attended mode — if an inspector or a technician has to be present for operating the device — or in an automated manner with *unattended monitoring systems (UMSs)*. There are two broad categories of *NDA* based on ionizing radiation:

— Passive analysis (*assay*), in which the measurement refers to spontaneous emissions of neutrons or gamma rays, or to the total decay energy;
— Active analysis (*assay*), in which the measurement refers to a stimulated emission (e.g. neutron or photon induced fission).

NDA of many other physical quantities of interest — including mass, temperature or non-ionizing radiation such as Cerenkov glow — can be used for the verification of *nuclear material*.

6.20. Gamma ray spectrometry. Measurement of the spectrum (energy and intensity) of gamma rays incident upon a detector for the purpose of establishing the identity and abundance of *isotopes*. This is done by referencing the measured spectrum to well established nuclear data libraries for specific *isotopes*, or in comparison with spectra obtained from standards in known quantities under well defined geometrical configurations.

Mathematical (e.g. in situ object counting system (ISOCS) based) absolute detector efficiency *calibrations* are sometimes used to characterize a counting geometry and interpret measured spectra when representative *calibration* standards are not readily available.

High resolution *gamma ray spectrometry*, obtained using instruments such as high purity germanium (HPGe) detectors, is essential for *plutonium* isotopic analysis and analysis of the spectra of fission products in spent fuel, while *gamma ray spectrometry* measurements of *uranium enrichment* can sometimes be taken with lower resolution, for example with sodium iodide (NaI) or lanthanum bromide ($LaBr_3$) detectors.

In addition, advanced *unattended monitoring systems (UMSs)* use *gamma ray spectrometry*, sometimes in combination with *neutron coincidence counting*, to provide independent measurement of *nuclear material*.

6.21. Gamma ray scanning. Measurement of gamma ray emission as a function of position along an object (e.g. measurement of the gamma ray emission profile along a fuel rod to verify its loading with pellets).

6.22. Scintillation detector. A device which responds to incident gamma rays or neutrons by absorbing energy in a scintillator, which then emits photons that are collected and counted. The most common scintillator for gamma rays is thallium drifted sodium iodide (NaI(Tl)) and lanthanum bromide ($LaBr_3$); for neutrons, a variety of organic and inorganic liquid and solid scintillators can be employed. For example, scintillation detectors are used in the HM-5 (scintillation detector) as well as in *unattended monitoring systems (UMSs)*.

6.23. Semiconductor detector. A device which detects gamma rays by means of the induced charge displacement in a semiconducting material, such as germanium (Ge), cadmium telluride (CdTe), cadmium zinc telluride (CdZnTe or CZT) or silicon (Si). *Semiconductor detectors* are characterized by good energy resolution and relatively fast timing characteristics. To achieve the best performance in terms of energy resolution, cooling of the detector — either with liquid nitrogen or with mechanical coolers — is required.

6.24. Neutron counting. Measurement of neutron emission from *nuclear material*, the emission being either spontaneous or induced by irradiation with neutron sources, in order to identify and measure the *nuclear material*. Detection of neutrons is normally accomplished by utilization of a neutron induced reaction (e.g. with ^{10}B, ^{3}He or fission chambers), resulting in the production of a charged particle which can be detected by its ionizing effect in the tube gas.

6.25. Neutron coincidence counting. A technique that detects correlated prompt neutrons from spontaneous or induced fission in a sample and distinguishes them from uncorrelated neutrons from other sources (such as other fission events, or (alpha, n) reactions) by taking the difference between detected events that occur closely together in time (real and accidental correlations) and those that are randomly distributed in time (accidental correlations). The real correlated event rate is directly related to the amount of *fissionable material* in the sample. The relation is typically determined through *calibration* with relevant standards.

6.26. Neutron multiplicity counting. A variation on the coincidence counting technique described for *neutron coincidence counting.* Coincidence counting involves measurement of the total number of neutrons detected (single rate) and a statistical determination of the number of twofold coincidences (double rate) by analysing the time history of the detected neutrons. The measurement of large *plutonium* or *uranium* samples with *neutron coincidence counting* requires additional assumptions and mathematical analysis to account for neutron multiplication and to accurately determine *nuclear material* mass. Multiplicity counting includes circuitry to determine higher order coincidences (e.g. triple rate); this allows the direct measurement of neutron multiplication without additional assumptions. This technique is useful to measure impure *nuclear material* where the assumptions required for twofold coincidence counting are not met. Multiplicity counters usually have a very high efficiency (>60%), which is needed to measure threefold, or higher order, coincidences with reasonable counting times.

6.27. Cerenkov radiation detection. A method for the verification of irradiated nuclear fuel in storage pools. Irradiated fuel immersed in water emits fast electrons that induce a characteristic blue glow in the water. Electro-optical image intensifiers have been adapted to observe this glow from above a storage pool. When aligned vertically above the tops of fuel assemblies, a Cerenkov viewing device can distinguish irradiated fuel items from non-fuel items. The quantity of Cerenkov light is detected by devices such as the analog improved Cerenkov viewing device (ICVD), the digital Cerenkov viewing device (DCVD) or the next generation Cerenkov viewing device (XCVD) and can be evaluated to confirm the integrity of spent fuel assemblies.

6.28. Safeguards Analytical Laboratory (SAL). Includes the Nuclear Material Laboratory (NML) and the Environmental Sample Laboratory (ESL), both located in Seibersdorf, Austria. The NML is responsible for *destructive analysis (DA)* and *non-destructive assay (NDA)* of *nuclear material samples*, and the ESL processes and analyses *environmental samples* for *IAEA safeguards* purposes. The SAL also provides support for both *DA* and *environmental sampling (ES)* programmes through the supply of sampling equipment, quality assurance and training of *IAEA inspectors*.

6.29. Network of Analytical Laboratories (NWAL). A group of laboratories in IAEA Member States that have been officially qualified for the analysis of *nuclear material* and *environmental samples*, as well as the provision of *reference materials* for the *Safeguards Analytical Laboratory (SAL)*.

6.30 Gamma ray counting. Measurement of the gamma ray emission from *nuclear material* in order to identify and/or measure the *nuclear material*. Gamma emission is a signature, in particular, of irradiated fuel and depends on the fuel history. To this end, low sensitivity detectors, such as *ion chambers* or silicon PIN diodes, are normally used. If the fuel history is known, the recorded emission rate can be compared with the expected gamma emission obtained by model calculation.

6.31. Ion chamber. A gas filled device which detects gamma rays by sensing the direct ionization generated in the gas by their interaction with the gas atoms. *Ion chambers* give a measure of the average rate of the gamma ray field to which they are exposed and therefore cannot be used in *gamma ray spectrometry* applications. They are used in *gamma ray counting* applications with very intense gamma ray fields, such as inside reactor cores, or for the *assay* measurement of irradiated fuel assemblies (e.g. a fork detector system).

6.32. Passive neutron coincidence counter. A device that utilizes the *neutron coincidence counting* technique. *Passive neutron coincidence counters* are used to measure *nuclear material* with relatively high spontaneous fission rates such as *plutonium*. For example, the high level neutron coincidence counter (HLNCC) is designed to handle high count rates and therefore large samples of *plutonium*, and the plutonium canister assay system (PCAS) is designed to determine the *plutonium* mass in a *mixed oxide (MOX)* canister.

6.33. Active neutron coincidence counter. A device that utilizes the *neutron coincidence counting* technique and detects prompt neutrons from fission events induced in *fissionable materials* such as *uranium*. Similar to passive counters, active counter systems consist of a data acquisition module coupled with a detector head which incorporates an isotopic source (e.g. AmLi) that randomly produces neutrons used to interrogate a fissionable sample. Various instruments have been developed which incorporate this technology, for example the active well coincidence counter (AWCC).

6.34. X ray fluorescence (XRF). A non-destructive analytical technique used to determine the elemental composition of materials by measuring the fluorescent (or secondary) X rays emitted from a sample when it is excited by an X ray source. Two major types of XRF systems are available: energy dispersive XRF (EDXRF) systems and wavelength dispersive XRF (WDXRF) systems.

XRF analysers determine the chemistry of a sample by measuring the fluorescent (or secondary) X rays emitted from a sample when it is excited by a primary X ray source. The primary X ray source could be internal to the material (passive XRF) or external (active XRF). For example, the IAEA uses an XRF identifier for alloys.

The WDXRF technique is used at the IAEA's Nuclear Material Laboratory to determine concentrations of major elements in inspection samples. It can also be used to characterize impurities in *uranium* bearing materials in order to complement *inductively coupled plasma mass spectrometry (ICP-MS)* results.

6.35. Inductively coupled plasma mass spectrometry (ICP-MS). An elemental analysis technique capable of detecting most of the elements in the periodic table in sample solutions at milligram to nanogram levels per litre.

At the *Safeguards Analytical Laboratory (SAL)*, ICP-MS is used for impurity analysis in samples of uranium materials as well as for assessing elemental composition of *environmental samples* and other samples. It can also detect different *isotopes* of the same element, making it suitable for *isotope* ratio measurements.

6.36. Combined procedure for uranium concentration and enrichment assay (COMPUCEA). A field deployable destructive analytical method that combines L-edge transmission and *gamma ray spectrometry* to measure respectively the *uranium* element mass fraction and the ^{235}U *enrichment* in an inspection sample subject to bias *defect* verification.

The *COMPUCEA* method has been applied at various *sites* of the *nuclear fuel cycle*, as its timely and accurate on-site results are one of the main advantages, and it is particularly adapted for high *throughput* facilities requiring quick analytical results.

6.37. Pu(VI) spectrophotometry (PUSP). A simple and rapid *destructive analysis (DA)* technique for the quantitative determination of *plutonium* concentration in aqueous solutions. *PUSP* is widely used in the nuclear field and enables reliable measurements in medium and high radioactive environments (hot cells), including highly radioactive liquid *waste* samples.

The general principle is based on the quantitative oxidation of *plutonium* to the hexavalent state by adding cerium(IV) or silver oxide in a nitric acid medium and measuring the absorption peak at wavelength with a spectrophotometer. The Pu(VI) peak is sharper and more intense than those of Pu(IV) and Pu(III), and therefore more appropriate for quantitative *assay*. The method responds to *plutonium* concentration levels down to µg/g, significantly lower than the K-edge method. It is less precise than *isotope dilution mass spectrometry (IDMS)* but provides faster results and requires a smaller number of staff and a less expensive set-up.

6.38. Equipment Radiation Monitoring Laboratory (ERML). The IAEA laboratory which provides radiation monitoring of items returned from verification activities in the field such as safeguards systems, *seals* and *environmental samples*. It is located at IAEA Headquarters in Vienna.

6.39. Sample transport. There are three categories used for transporting most *IAEA safeguards* related samples:

(a) **Exempt consignment**. This is the most common method for transporting *environmental samples*. The quantities of radioactive material fall below the threshold for which requirements for transport apply (as determined by the IAEA Transport Regulations[4]); hand carrying is permitted in this category.

(b) **Excepted package**. This is the most common method for shipping *uranium* samples. The majority of requirements for the transport of radioactive material are waived in this category, including UN numbers 3507 for UF_6 samples and 2910 for other *uranium* compounds.

(c) **Type A package**. This is the most common method for shipping *plutonium* bearing samples. The full requirements for the transport of radioactive material apply in this category, including UN number 2915.

6.40. Laser induced breakdown spectroscopy (LIBS). This technique involves focusing a short pulsed laser onto a target material to produce a plasma plume of characteristic emissions of relaxing ions excited by the laser. The photons from the plasma plume can be analysed to gain information about the elemental, and even the isotopic, composition of the material.

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[4] INTERNATIONAL ATOMIC ENERGY AGENCY, Regulations for the Safe Transport of Radioactive Material: 2018 Edition, IAEA Safety Standards Series No. SSR-6 (Rev. 1), IAEA, Vienna (2018).

7. CONTAINMENT AND SURVEILLANCE

The IAEA's safeguards approach for a facility is based on nuclear material accountancy as a safeguards measure of fundamental importance, complemented by containment and surveillance (C/S) measures and monitoring. The most desirable combination of containment and surveillance is that which permits the safeguards objectives to be achieved at acceptable costs and with minimum intrusion into routine facility operations.

7.1. Containment. Structural features of a *facility*, containers or equipment which are used to maintain the continuity of knowledge of items by preventing undetected access to, or movement of, the items. The continuing integrity of the *containment* is usually ensured by complementary *containment/surveillance measures*.

7.2. Surveillance. The collection of information through direct inspector observation or recording devices for use in maintaining continuity of knowledge of *nuclear material*, *containment*, IAEA assets and *site* activities.

7.3. Containment/surveillance device. An item of equipment used to perform one or more containment/surveillance (C/S) functions and capable of providing its own C/S results. Examples of *C/S devices* are *surveillance* cameras, *seals* and *unattended monitoring systems (UMSs)*.

7.4. Seal. A tamper indicating device used to join movable segments of a *containment* in a manner such that access to the *containment's* contents without opening the *seal* or breaking the *containment* is prevented. A sealing system comprises the *containment* enclosing the material to be safeguarded, the means of applying the *seal* and the *seal* itself. All three components must be examined in order to verify that the sealing system has fulfilled its function of ensuring continuity of knowledge of the identity and integrity of the material concerned.

Two types of *seal* are used by the IAEA:

(a) **Active seals**. Reusable *seals* with an internal, battery powered electronic circuit that continuously monitors the integrity of the sealing loop (e.g. fibre optic cable) and logs opening and closing events. The *seal* identity and the integrity of the data from the *seal* are maintained via strong cryptographic means. The *seal* can be verified in the field and/or monitored remotely, where applicable.

(b) **Passive seals**. Non-reusable *seals* with no electronic circuits monitoring the integrity of the *seals*. They can be used with a variety of sealing loops (e.g. metal wire, fibre optic cable), depending on the *seal* type. The individual *seal* identity is established through a unique ID number and unique body patterns or markings. Depending on the *seal* type, the *seal* can be verified in the field using electronic verifiers or at IAEA Headquarters (or as agreed between the IAEA and an external party in the case of *seals* approved for joint use).

7.5. Containment/surveillance measures. The application of *containment* and/or *surveillance* provided by *containment/surveillance devices* and *systems* to complement *nuclear material accountancy*. The use of containment/surveillance (C/S) measures is aimed at verifying information on the movement of *nuclear material* or other material, equipment and samples, and/or preserving the integrity of safeguards relevant data. In many instances, *C/S measures* cover the periods when the inspector is absent, thus ensuring the continuity of knowledge for the IAEA and contributing to cost effectiveness.

Examples of applications of *C/S measures* include the following:

(a) During *verification of nuclear material flows within an MBA* and *inventory verification*, to ensure that each item is verified without duplication and that the integrity of samples is preserved;
(b) To confirm that there has been no change to the *inventory* previously verified and thus reduce the need for remeasurement;
(c) To ensure that IAEA equipment, working papers and supplies have not been tampered with;
(d) If necessary, to isolate ('freeze') *nuclear material* that has not been verified until it can be measured.

The indication of an *anomaly* by *C/S measures* does not necessarily indicate that material has been removed. The ultimate resolution of C/S *anomalies* is provided by *nuclear material* verification. If any *C/S measure* has been, or may have to be, compromised, the IAEA will, unless agreed otherwise, be notified by the fastest means available. Examples of compromise include *seals* which have been broken inadvertently or in an emergency, and *seals* which have the possibility of being removed after advance notification to the IAEA has been agreed upon between the IAEA and the State.

7.6. System of containment/surveillance measures. A combination of *containment* and/or *surveillance* measures that are used to maintain continuity of knowledge of *nuclear material*, IAEA assets and *site* activities. Each containment/surveillance (C/S) system is designed to meet a purpose specified in the IAEA's *safeguards approach*. To increase reliability, a C/S system can include one or several *C/S devices*. Dual *C/S measures* are normally applied if verification of *nuclear material* is difficult, in order to increase confidence in the C/S results and reduce the requirements for re-verification.

7.7. Vulnerability assessment. A formal evaluation of the security of IAEA equipment, consisting of a vulnerability review by the IAEA and/or by external experts. *Vulnerability assessment* is part of the *equipment authorization* process.

7.8. Joint use arrangement (JUA). A set of documents that specify the joint use of equipment through specific procedures and approaches, as appropriate. This documentation addresses the procedures associated with the equipment and any additional measures that will be employed to ensure the independence of the IAEA's activities and *safeguards conclusions*.

7.9. Joint use equipment (JUE). *Safeguards equipment* authorized by the IAEA for possible use jointly by the IAEA and an external party (a State or regional authority or a *facility* operator). The specific joint use case is part of the authorization. The *JUE* is authorized for case scenarios described in the *joint use arrangement (JUA)*.

7.10. Tamper indication. Physical or electronic evidence of any unauthorized or undeclared attempt, physically or electronically, to access or alter IAEA equipment or to compromise the confidentiality, integrity or authenticity of equipment, *containment* or data.

7.11. Surveillance review system. Equipment, including relevant software, used to review *surveillance* data recorded by *surveillance* systems. Examples of *surveillance review systems* are General Advanced Review Software (GARS) and Next Generation Surveillance Review (NGSR) software.

7.12. Unattended monitoring system (UMS). A tamper indicating system that operates continuously and autonomously to perform measurements without inspector intervention. *UMSs* are employed in applications of *nuclear material accountancy* using *non-destructive assay (NDA)*, *containment/surveillance devices* or a combination thereof.

UMSs consist of radiation detectors and/or sensors for physical and electrical properties connected to an industrial cabinet containing data acquisition equipment, power management components, and communication and other support devices.

The advantages of these systems include a reduction of inspection efforts and radiation exposure to inspectors, and of the level of intrusiveness to the operation of nuclear *facilities*. Where agreed with the State, data may also be transmitted remotely to the IAEA.

For unattended measurements, specific criteria must be met, including measures to ensure *tamper indication*, data authentication and *encryption/decryption*.

7.13. Core discharge monitor (CDM). An *unattended monitoring system (UMS)* featuring neutron and gamma detectors installed close to the core of an on-load, refuelled *power reactor* to monitor the charge and discharge of irradiated fuel bundles.

7.14. Spent fuel bundle counter. An *unattended monitoring system (UMS)* featuring gamma detectors located within the guide tubes to count the irradiated fuel bundles as they are discharged to the spent fuel storage bay of an on-load, refuelled *power reactor*.

7.15. Passive Gamma Emission Tomographic (PGET) System. A partial *defect* test system for spent fuel and closed containers capable of detecting single pin diversion. The *PGET System* consists of a toroid watertight compartment (enclosure) and a control unit, connected by a composite data and power cable.

7.16. Reactor power monitor. A neutron monitoring system placed outside the reactor biological shield to monitor the power level of the reactor.

7.17. Thermohydraulic power measurement. A technique that measures the temperature and flow rate of the reactor coolant in order to calculate the actual thermal power produced by the reactor. This measurement can reveal whether the reactor has been used to irradiate targets for the production of undeclared *nuclear material* and can be used to determine whether substantial amounts of fissile material might have been generated. The technique is mainly used in nuclear *research reactors* through the unattended advanced thermohydraulic power monitor (ATPM) system.

7.18. Criticality check. A technique that measures the variation of the neutron count rate inside the reactor core with respect to reactivity change. The reactor period is calculated from a fit of the exponential increase of the neutron count rate when the reactor is in a supercritical state. If details of the reactor and fuel type are known, the reactivity can also be calculated. *Criticality check* measurements are performed with an in-core neutron detector, such as B-10 tubes or fission chambers, coupled with a counter.

7.19. Radiation passage monitor. A device used to detect, by the radiation emitted, the passage of *nuclear material* through openings in a *containment*. For example, panels of ^{3}He proportional counters and gamma ray detectors can be used to confirm irradiated fuel movements through a gateway. These can also be referred to as gate monitors.

7.20. Authentication measures. Measures providing the IAEA with assurance that information obtained from any *safeguards equipment* actually comes from the particular equipment and is genuine. In the case of digital data, the use of certified authentication algorithms contributes significantly to the required level of data authentication in unattended *safeguards equipment*.

7.21. Encryption/decryption. A system of hardware, software and processes for encoding/decoding data, messages and other information in such a way that only designated safeguards inspectors and other authorized IAEA staff can read them.

7.22. Equipment state of health data. Data on the operating status of equipment, especially information that provides an indication of any (potential) malfunction, limitation on the equipment's capacity to operate as planned or tampering. Receiving the state of health data at a regular frequency makes it possible to detect failures of equipment or tampering early enough for remedial actions to be implemented to satisfy timeliness requirements.

7.23. Safeguards equipment. A complete, functional system or device (i.e. instruments, core components, or other components), which may include a combination of hardware, software and/or firmware to make measurements and observations, used to acquire and evaluate safeguards data. The term 'instrument' is used synonymously with 'equipment'.

7.24. Immobilization mechanism. A tool — such as a *seal*, *surveillance* or other authorized *safeguards measure* — which provides continuity of knowledge of the static position of a movable *containment* structure, thus avoiding the need for periodic re-examination of *containment* surfaces that are difficult to access. For example, an IAEA *seal* can be used between a spent fuel storage container and an immovable object to avoid having to lift the container for visual examination of its bottom surface.

7.25. Remote data transmission (RDT). A technique whereby safeguards data, collected by *RDT* systems, are transmitted in a secure and reliable way off-site to IAEA Headquarters, a regional office or another IAEA location for review and evaluation purposes. *RDT* enables better utilization of equipment, more optimized planning of *inspections* and a reduction in the inspection effort needed to meet verification requirements. It also allows the implementation of more efficient and timely equipment maintenance driven by the analysis of *equipment state of health data*, and even remote maintenance in certain cases.

7.26. Equipment authorization. The IAEA process that provides assurance that an instrument or system of *safeguards equipment* meets its intended safeguards function (i.e. that the results provided by an instrument or system can be used effectively in support of the process of nuclear verification). Authorization can only be sought after the equipment is validated. After successful authorization of a safeguards system or instrument, all related metadata are entered into the dedicated *safeguards equipment* database.

7.27. Equipment validation. The IAEA process that provides assurance that an instrument or system meets all required design characteristics and features, and functions safely and securely, thereby confirming the design quality of any type of equipment (i.e. component, instrument or system). Even where individual components have already been independently validated, their integration must be validated. Validation confirms that equipment can be deployed and needs to have occurred before authorization can take place.

7.28. Safeguards system with remote data transmission capability. Any unattended *containment/surveillance*, monitoring or *measurement system* authorized for *IAEA safeguards* use which is capable of transmitting data off-site, via *remote data transmission (RDT)*, to IAEA Headquarters, a regional office or another IAEA location. The system's internal recording capability is used for backup purposes. These systems transmit data ranging from *equipment state of health data* to verification data. The redundancy feature is particularly useful for unattended *containment/surveillance devices* and monitoring devices.

7.29. Security critical component. Any hardware or software component of equipment containing confidential or sensitive information which is critical to its security. Information produced by equipment with a compromised security critical component cannot be authenticated by the IAEA and cannot be used to make independent measurements or observations for drawing *safeguards conclusions*.

7.30. Near Real Time System (NRTS). A system that supports near real time verification and performs automated analysis, matching operator declared events with events generated through *safeguards equipment* installed in a given *facility*. An *NRTS* has the capability of providing notifications to the *facility* operator to indicate that (i) required safeguards data have been collected; (ii) required operator declarations have been received and are consistent with previously declared data; (iii) the data sets match; and (iv) given the previous points, a subsequent, specific (often irreversible) process step, such as the welding of a spent fuel canister before it enters long term storage, may then be performed.

8. ENVIRONMENTAL SAMPLING

Environmental sampling is one of the IAEA's safeguards measures which contribute to the assurance of the absence of undeclared nuclear material and activities. Collection of environmental samples combined with ultrasensitive analytical techniques, such as mass spectrometry methods, particle analysis and low level radiometric techniques, can reveal information about past and current activities related to the handling of nuclear material. For more information on this subject, see [IAEA/NVS/1].

8.1. Environmental sampling (ES). In the context of *IAEA safeguards*, the collecting of samples from the environment with a view to analysing them for traces of materials that can reveal information about *nuclear material* handled or activities conducted. Usually, *ES* is performed on various surfaces, such as equipment or building structures. Other media (including, but not limited to water, vegetation or soil) may also be sampled.

8.2. Location specific environmental sampling. As defined in Article 18.f of [540]:

> "[T]he collection of environmental samples (e.g. air, water, vegetation, soil, smears) at, and in the immediate vicinity of, a location specified by the Agency for the purpose of assisting the Agency to draw conclusions about the absence of undeclared *nuclear material* or nuclear activities at the specified location."

8.3. Wide area environmental sampling. As defined in Article 18.g of [540]:

> "[T]he collection of environmental samples (e.g. air, water, vegetation, soil, smears) at a set of locations specified by the Agency for the purpose of assisting the Agency to draw conclusions about the absence of undeclared *nuclear material* or nuclear activities over a wide area".

Article 9 of [540] provides that the IAEA will not seek access to *locations* specified for *wide area environmental sampling* until the use of such sampling and the procedural arrangements therefor have been approved by the IAEA Board of Governors and following consultations between the IAEA and the State.

8.4. Swipe sampling. The collection of *environmental samples* by swiping a surface with a piece of ultraclean medium (such as cotton, cellulose, or other material) to remove from the surface traces of materials present.

8.5. Point sample. A collection of replicate swipes from a contiguous area at a single *location*. A *point swipe* sample is used to characterize activities at a specific *location*.

8.6. Composite sample. A collection of replicate swipes from contiguous areas at multiple *locations*. *Composite samples* are used to characterize operations over a wider area than a *point sample*.

8.7. Pre-inspection check sample. A swipe sample taken from the surface of the hands and clothing of the *sampling team* before they enter a *site*, *facility* or other *location* where *environmental sampling (ES)* is to be performed which can be used to check for possible *cross-contamination* from the *sampling team*.

8.8. Cross-contamination. Unintended introduction of material to the sample which could lead to false results. Possible sources of *cross-contamination* are the sampling medium itself, the sampling kit, another sample, the *sampling team* and post-sampling handling, including analysis.

8.9. Baseline environmental signature. Data (derived from the analysis of *environmental samples* taken at, and in the vicinity of, a *location*) which characterize *nuclear material* handled and activities conducted at that *location*. Any inconsistencies between the results of the analyses and the declared activities at the *location* are followed up with the State concerned. The *baseline environmental signature* is used as a reference to evaluate the analytical results for *environmental samples* collected later.

8.10. Sampling team. A team of at least two persons performing *swipe sampling*, except for sampling inside hot cells. The team consists of a sampler (collector) and an assistant working according to the procedures intended to keep the risk of *cross-contamination* during the sampling process as low as possible. The collector comes into direct contact with the medium used to take swipe samples; the assistant does not, except when taking a *pre-inspection check sample*. In the case of sampling inside hot cells, the *facility* operator is responsible for the collection, handling and packaging of samples under the direction of the *IAEA inspector*.

8.11. Environmental sampling kit. A set of items to be used for taking *environmental samples*, preassembled in the strictly controlled environment of a clean room to guarantee the absence of contamination that may compromise the *environmental sampling (ES)* results. The following are the most common *ES kit* types:

(a) A standard swipe *ES kit* containing several pieces of cotton cloth;
(b) A hot cell sampling kit, intended for sampling inside hot cells using cellulose swipes mounted on a plastic holder, designed for handling by remote manipulators;
(c) A swab *ES kit* containing several swabs (i.e. a cotton tip on a wooden handle), intended for the collection of samples from difficult to reach or heavily contaminated points.

8.12. Screening measurement. Measurement performed on each *environmental sample* received at the Environmental Sample Laboratory (ESL) to determine its radioactivity level and to detect the presence of actinide elements (primarily *uranium* and *plutonium*) and fission or activation products. This is usually performed using *gamma ray spectrometry* and *X ray fluorescence (XRF)*.

8.13. Bulk analysis. The analysis of the entire swipe, swab or other type of sample through digestion and chemical separation to determine the amount of *uranium*, *plutonium* and/or other actinides, and the average isotopic composition of certain elements (typically actinides).

8.14. Particle analysis. The analysis of individual micrometre sized particles extracted from the *environmental sample* for their size, morphology and elemental and isotopic composition. The analysis of individual particles within a sample can reveal the presence of different materials or multiple activities.

8.15. Fission track analysis. A technique applied to *environmental samples* to detect and locate particles containing fissile *nuclides* (e.g. ^{239}Pu, ^{235}U). This technique involves transferring particulate material from the sample onto a fission track detector substrate, irradiating the detector with thermal neutrons and etching the resulting fission tracks. *Fission track analysis* is typically combined with *thermal ionization mass spectrometry (TIMS)* to provide the isotopic composition of *uranium* and *plutonium* in individual particles.

8.16. Scanning electron microscopy (SEM). A technique used to image and analyse individual micrometre sized particles extracted from an *environmental sample* by depositing them on a conducting substrate and examining them with a high magnification electron beam. Secondary electron imaging can be used to determine the size and morphology of a particle; its elemental compositions can be derived through energy X ray spectroscopy (EDS) or wavelength dispersive X ray spectroscopy (WDS).

8.17. Secondary ion mass spectrometry (SIMS) (including large geometry SIMS (LG-SIMS)). A technique for measuring the isotopic composition of individual micrometre sized particles extracted from an environmental swipe sample by depositing them on a conducting substrate and bombarding them with a high energy ion beam. The ejected secondary ions are analysed using a mass spectrometer to determine the isotopic composition of the particle. *LG-SIMS* provides greater sensitivity and precision for the analysis of *minor uranium isotopes*.

8.18. Material characterization. Analysis of *minor uranium isotopes*, elemental impurities and other physical or chemical characteristics of *nuclear material* controlled by the relevant industrial specifications. In many cases*, nuclear material* samples are collected for dual purposes; that is, they are submitted, in parallel, for *material characterization* and for *destructive analysis (DA)* for accountancy verification. Characterization may also be requested for samples of non-nuclear material, for example to assess the samples conformity with technical requirements for specific nuclear applications.

8.19. Multi-collector inductively coupled plasma mass spectrometry (MC–ICP-MS). A technique for precise *isotope* analysis of radionuclides and stable elements (e.g. *uranium*, *plutonium*, strontium, lead). This is *inductively coupled plasma mass spectrometry* (*ICP-MS)* equipped with multiple collectors for simultaneous detection of ions of interest. Modern *MC–ICP-MS* instruments have extremely high sensitivity for *uranium* and *plutonium isotopes*, but also suffer from polyatomic interferences, therefore requiring an efficient purification of *uranium* and *plutonium* fractions prior to analysis. *MC–ICP-MS* is used by the IAEA's *Safeguards Analytical Laboratory (SAL)* for *bulk analysis* of *environmental samples* for *uranium* and *plutonium* quantities and isotopic composition.

8.20. Minor uranium isotopes. Those *isotopes* of *uranium* which are less abundant or do not occur in nature (i.e. all *uranium isotopes* except ^{238}U and ^{235}U).

8.21. Environmental samples. In the context of *IAEA safeguards*, samples collected from the environment with the purpose of being analysed for parameters that can reveal information about *nuclear material* handled or related activities conducted at the sampled *location*. These samples are usually collected from various surfaces, following an established procedure and using one of the authorized *environmental sampling kits*, but may also include samples of other environmental media.

9. STATISTICAL CONCEPTS AND TECHNIQUES FOR NUCLEAR MATERIAL VERIFICATION

Material balance accounting is an integral part of nuclear material verification. A requirement of material balance accounting is that the quantities of nuclear material in all components of the material balance equation be measured. The measurement results are subject to uncertainty due to errors inherent in all measurement systems. Statistical concepts and techniques are used to estimate the measurement uncertainty associated with quantities of nuclear material amounts and to establish and maintain control over the quality of measurements. They are also used in the formulation of sampling plans for nuclear material accountancy and verification, and as a basis for tests of statistical safeguards significance in the formulation of safeguards conclusions by the IAEA.

9.1. Material balance evaluation. A statistical evaluation performed by the IAEA, once the material balance is closed, to:

(a) Test whether any non-zero *material unaccounted for (MUF)*, *shipper/receiver difference (SRD)*, *D statistic*, *operator–inspector differences* or *inspector's estimate of MUF (IMUF)* can be explained by *measurement uncertainty* or is more likely to reflect other causes;
(b) Assess whether trends over time in *MUF, SRD* or certain *inventory changes* (e.g. when used as *MUF tuners*) indicate other than expected behaviour.

The uncertainties which are associated with the declared amounts of material making up each of the four components of the material balance equation are applied to the item or *stratum* amounts and combined to estimate the uncertainty of *MUF*, denoted as σ_{MUF}. The *material balance evaluation* as performed by the IAEA includes the following:

(a) Estimation of σ_{MUF}, evaluation of the operator's declared *MUF*, and assessment of associated trends and of the *cumulative material unaccounted for (CuMUF)*;
(b) Comparison of σ_{MUF} with the *international standards of accountancy (ISA)*;
(c) Estimation of the standard deviation of *SRD* (denoted as σ_{SRD}), evaluation of *SRD*, and assessment of associated trends and of the *cumulative SRD*;
(d) Estimation of the standard deviation of the *D statistic* (denoted σ_{D}) and evaluation of the *D statistic* for *strata* verified by the IAEA and for the *material balance area (MBA)*;
(e) Evaluation of *IMUF*.

Note: Statistical *MUF* evaluation applies only to bulk handling *MBAs*.

9.2. Inspector's estimate of MUF (IMUF). The *material unaccounted for (MUF)* computed on the basis of amounts of material measured by *IAEA inspectors* instead of operator declarations. In practice, an inspector *stratum* amount is derived by extrapolating (using the operator declared *stratum* amount) the measurements of a random sample of items. For those *strata* for which no items were measured by the inspector, the operator's *stratum* amount is used. When most of the major *strata* have been measured by the inspector, *IMUF* (algebraically equal to MUF-D) can support the detection of *diversion into MUF*, *diversion into D* or both.

9.3. Operator–inspector difference. The difference between the operator's declared value and the *IAEA inspector's* measured value for the quantity of *nuclear material* in an item. The relative *operator–inspector differences* ((operator value − inspector value)/operator value) are statistically tested to assess whether the difference could be explained by *measurement uncertainties*. Significant *operator–inspector differences* are indicators of a possible diversion (*diversion into D*) and require further investigation.

9.4. D statistic. The *operator–inspector differences* observed in verification measurements performed on a *statistical sample* projected onto a *stratum* (stratum D) or *material balance area (MBA)* (D) level.

9.5. MUF tuners. *Inventory changes,* such as *measured discards* (LD), transfers to *waste* (DT) or *nuclear loss* (LN), or *corrections* to accountancy declarations, which, if not verified for authenticity, can be used to adjust the *material unaccounted for (MUF)* to a desired value in order to conceal *diversion of nuclear material.*

9.6. Diversion into MUF. A *concealment method*, of particular concern in *bulk handling facilities*, in which an amount of declared material M is removed from a *material balance area (MBA)* and the *accounting records* are adjusted to reflect the amount M removed. There is no falsification of these records. The diverted amount M is part of the declared *material unaccounted for (MUF)* which is evaluated when performing the *material balance evaluation*. The diverter assumes that the uncertainty of *MUF* (σ_{MUF}) is large enough to possibly mask the removal of M. *Diversion into MUF* may be detected through observation of a *statistically significant* value of *MUF*. However, if σ_{MUF} is large because measurement quality is poor, because there are large quantities of poorly or improperly accounted for material, or because of very large inventories and/or *throughputs* in a *facility*, then the probability of detection of *diversion into MUF* is low.

Note: *Diversion into MUF* may also include the use of *MUF tuners*.

9.7. Diversion into SRD. A *concealment method* similar to *diversion into MUF* involving the *diversion of nuclear material* transferred between *material balance areas (MBAs)*. Diversion can be detected through *material balance evaluation* by a statistical test based on σ_{SRD}.

9.8. Diversion into D. A *concealment method* in which the diverter removes an amount of declared material M but does nothing to the operator's *accounting records* to hide the diversion. The *accounting records* are therefore now false (having been falsified). The diversion causes a *discrepancy* (i.e. *defect*) between the material declared to be present and the material actually present. The only way to detect the diversion is for the inspector to measure the containers from which M was removed and to compare the measured value with the operator's declared value. This *concealment method* is referred to as *diversion into D* because it can potentially be detected through observation of a *statistically significant* value of the *D statistic* during *material balance evaluation* and/or through significant individual *operator–inspector differences*. *Diversion into D* can be concealed if measurement quality is poor and the variance of D (σ_{D}) is large.

9.9. Defect. For verification purposes, a *statistically significant* difference between the declared amount of *nuclear material* or non-nuclear material (i.e. the quantity shown in the operator's records) and the amount of material as determined by the IAEA's verification measurements.

Three levels of *defects* must be considered when verifying *nuclear material*:

(1) Gross *defect* refers to a *defect* in an item or a *batch* that has been completely falsified to the maximum extent possible so that all or most of the declared material is missing.
(2) Partial *defect* refers to a *defect* in an item or a *batch* that has been falsified to such an extent that some fraction of the declared amount of material is still present.
(3) Bias *defect* refers to a *defect* in an item or a *batch* that has been slightly falsified so that only a small fraction of the declared amount of material is missing.

9.10. Sample size. The number of items to be verified in order to be able to draw conclusions about the population from which the sample is taken. For *IAEA* *safeguards* the basic formula used for estimating the total number of samples (n) to be selected in each *stratum* is:

$$n = N(1 - \beta^{1/D}) \text{ (rounded up to the nearest integer)}$$

where

N is the number of items in the *stratum*;
β is the specified non-detection probability;
D is [M/x], the minimum number of *defects* in the *stratum* needed to divert the goal amount M, rounded up to the next integer;

and x is the average *nuclear material* quantity in each item (each assumed to have the same *nuclear material* amount) in the *stratum*.

This formula approximates the sample size that would result from application of the hypergeometric probability distribution (i.e. sampling without replacement) in calculating the probability of selecting one or more *defects* in the sample and assuming that *measurement error* is negligible, so that the *detection probability* (which combines *selection probability* and *identification probability*) is the same as the *selection probability*. If the *measurement error* is non-negligible, the total sample size (n) should be allocated among several *IAEA accountancy verification methods*, specifically methods for detecting gross, partial and bias *defects*.

9.11. Measurement error. The amount by which the measured value differs from the true value. All measurements are subject to error. In measurements of *nuclear material*, *measurement errors* arise from bulk, concentration and isotopic measurements. The causes of *measurement error* include sampling (selecting a limited number of items from a population, or a small amount of material from a container (*representative sample* and *statistical sample*)), instrument *calibration*, statistical fluctuations due to limited duration counting time, environmental conditions and background. In *nuclear material accountancy* terminology, estimates of error variances include only those error sources that are attributable to the measurement process (i.e. *random error* and *systematic error*) and do not include mistakes (e.g. transcription mistakes).

9.12. Random error. A component of *measurement error* that occurs in remeasurements of the same quantity whose values vary in a random way according to some probability distribution, with both positive and negative deviations from zero. As the number of measurements increases, the mean of these random deviations approaches zero; consequently, the effect of *random error* can be reduced by repeating measurements. *Random error* variance is inversely related to measurement precision: the higher the precision, the smaller the *random error* variance.

9.13. Systematic error. Long term and short term *systematic error* are components of *measurement error* that remain constant over a series of measurements; consequently, the effect of *systematic error* cannot be reduced by repeating measurements. Short term *systematic errors* are in effect for a period that is shorter than the full analysis period and are considered random variables. Long term *systematic errors* (also referred to as bias) are in effect for the entire analysis period and are constant over the whole period. This type of error is usually related to accuracy, because it characterizes how close the measurement result is to the true value over the entire analysis period; the higher the accuracy, the smaller the long term *systematic error*. Short term or long term *systematic error* can be estimated by measuring standards. Sometimes a bias *adjustment* is made to adjust for long term *systematic error*.

9.14. Residual bias. An unknown *systematic error* that remains after a bias *adjustment* has been applied (i.e. after the measured values have been corrected for the part of the *systematic error* that can be estimated by *calibration* or by measuring standards).

9.15. Error propagation. The determination of the value to be assigned as the uncertainty of a given quantity, using mathematical formulae for the combination of *measurement uncertainties* for measurands (i.e. the quantities being measured) from which this quantity is being derived. *Error propagation* involves many considerations and the choice of a formula for computing the uncertainty depends on the functional relations of the measurands involved.[5] For example, the standard deviation of *material unaccounted for (MUF)* (σ_{MUF}) resulting from closing a material balance can be calculated by the application of the *error propagation* formulas that combine the errors of the individual *material balance components*. The standard deviation of the calculated *MUF* (or σ_{MUF}) is used to evaluate the statistical significance of *MUF*.

9.16. Limits of error. Limits set around a measured value using estimates of random and systematic measurement uncertainties which have been calculated

[5] Definition based on BROOKHAVEN NATIONAL LABORATORY, Safeguards Dictionary, Rep. WASH-1173, BNL, Upton, NY (1971).

from data acquired over a long period of time. These limits are the upper and lower bounds of a confidence interval. The term *'limits of error'* has the same meaning as the 'limits of accuracy' mentioned in para. 30 of [153].

9.17. Confidence limits. Limits set around a measured value or estimate that express a degree of confidence with regard to the true value of the measured or the estimated amount. For example, a confidence interval can be established for a *material unaccounted for (MUF)* value by setting the upper *confidence limit* at $MUF + 3\sigma_{\mathrm{MUF}}$ and the lower *confidence limit* at $MUF - 3\sigma_{\mathrm{MUF}}$, corresponding to the claim that with 99.73% confidence the true value of *MUF* lies within this interval. *Confidence limits* of the interval $MUF \pm 2\sigma_{\mathrm{MUF}}$ correspond to 95.45% confidence that the true value lies within the calculated interval.

9.18. Outlier. An observed or measured value that is unusually large or unusually small compared with the range of values expected from the observed or hypothesized distribution of similar observations or measurements. Since a suspected *outlier* may or may not be an observation of the population of interest, it is prudent to examine the circumstances surrounding the alleged *outlier* before rejecting it. For example, a mistake might have been made in recording the data. Statistical analytical methods exist for identifying *outliers* and for treating them for the purposes of data evaluation. However, discarding *outliers* for which there are no clear explanations can result in underestimation of variability within the population.

9.19. Performance values. Estimates of *measurement error* standard deviations derived by the IAEA from a statistical analysis of historical measurement data, often the paired *operator–inspector difference* data accumulated over a large number of inspections. The standard deviation estimates are apportioned between the operator and the *IAEA inspector* and are separated into *random* and *systematic* uncertainty components (associated with *random error* and *systematic error)*. *Performance values* are established on the basis of a *facility*, *stratum* and measurement method and are used for planning implementation of *IAEA safeguards* and for safeguards statistical data evaluation purposes.

9.20. Hypothesis test. A test of whether an assumption (i.e. hypothesis) is reasonable in view of the relevant data. The hypothesis being tested could refer to a characteristic, such as element concentration, or to a balance statistic, such as the operator's true *material unaccounted for (MUF)* or the true *operator–inspector difference*. The test may be either two-sided (e.g. testing for material loss or gain) or one-sided (e.g. testing only for loss). The hypothesis may also rest on assumptions, for example that the population sampled has a normal distribution.

For instance, an example of a safeguards relevant application of this test could be the hypothesis to be tested (called the null hypothesis) that the mean value of element concentration of a *batch* of UO_2 powder is 82.2%, while the alternative hypothesis is that the mean value is either greater or smaller than 82.2%. For this test, the *limits of error* must be set on both sides of 82.2%, such as 82.0% and 82.4%, to establish an interval for testing; the areas beyond the interval are called the *critical region*. One or more samples from the *batch* in question are analysed for element concentration. If the measured average concentration is within the established interval, there would be no evidence to reject the null hypothesis. If the measured concentration is in the *critical region*, the null hypothesis would be rejected.

9.21. Statistically significant. Describes a conclusion drawn when the null hypothesis is rejected. Safeguards relevant tests include test of *material unaccounted for (MUF), inspector's estimate of the MUF (IMUF)*, *operator–inspector difference* and *shipper/receiver difference (SRD)*. For example, suppose the null hypothesis is that the expected value of *MUF* is zero, which means there is zero loss of *nuclear material*. An interval is established around the hypothesized value of zero for the true *MUF* value for a given level of confidence and based on an estimated σ_{MUF}. If the observed *MUF* is within the interval around zero, there would be no reason to reject the null hypothesis that the true *MUF* is zero, thus the observed *MUF* would not be considered statistically significant. However, if the observed *MUF* is outside the interval, there is sufficient evidence to reject the null hypothesis, thus the observed *MUF* would be considered to be statistically significant. Traditionally, the estimated value of σ_{MUF} is assumed to be the true value of σ_{MUF}, and the *MUF* values are assumed to have a normal distribution with mean zero and standard deviation σ_{MUF}. This means that such intervals are simple to construct, typically by using $0 \pm 2\ \sigma_{\mathrm{MUF}}$ or $0 \pm 3\ \sigma_{\mathrm{MUF}}$, depending on the desired *false alarm probability*.

9.22. Type I error. In a *hypothesis test*, rejecting a null hypothesis when the null hypothesis is in fact true. The probability α of committing a type I error is called the significance level of the test and is also referred to as the *false alarm probability*. A type I error in the context of *IAEA safeguards* might result in falsely concluding that *nuclear material* has been lost when in fact no material has been lost. Therefore, the value of α chosen is generally very small (e.g. 1%).

9.23. Type II error. In a *hypothesis test*, failing to reject a null hypothesis when the null hypothesis is in fact false. This is commonly designated as having probability β. Since in the context of *IAEA safeguards*, failure to reject a null hypothesis is equivalent to a conclusion that diversion did not occur when in fact it did occur, the probability β of a type II error is commonly referred to as the non-detection probability.

9.24. Power of a test. In a *hypothesis test*, the probability of correctly rejecting a false hypothesis. The power of the test depends on the distributions of the two populations corresponding to the null and the alternative hypotheses. If the overlap of the null distribution (e.g. the true *material unaccounted for (MUF)* is 0) and the alternative distribution (e.g. the true *MUF* is some positive quantity) is small, then the power of the test is high. If the overlap of the two distributions is large, then the power of the test is low. In the case of a large overlap, more data (i.e. a larger *sample size*) are required to reduce the overlap and thus increase the power of the test. The power of the test is one minus the probability β of a *type II error*.

9.25. Attributes test. A test of a characteristic (or attribute) of an item to which the response is either 'yes' or 'no'. For example, *seal* verification is an *attributes test:* the *seal* is inspected and the result should be either that it shows evidence of tampering or it does not. Testing items by *non-destructive assay (NDA)* for radiation emission is also an *attributes test:* a tested item either emits radiation within a specified range or it does not. To simplify calculations, an *attributes test* is often assumed to have a zero mistake rate. However, in some *sample size* calculations, the mistake rate is assumed to be non-zero, and a corresponding non-zero *relative standard deviation (RSD)* of the measurements is used in the *attributes test*.

9.26. Variables test. A statistical test that consists of measuring, on a continuous scale, a quantitative characteristic of an item and determining the significance of the measured result as compared with the declared value on the basis of measurement uncertainties associated with the applied measurement methods. Weighing an item and measuring its element concentration by the analysis of a *representative sample* are examples of *variables tests*. When the results of such a quantitative measurement are used only to decide whether or not the item measured meets a specified criterion, which is a 'yes/no' decision, the test is described as a '*variables test* in attribute mode'.

9.27. Critical region. The region outside the bounds established for a *hypothesis test*. If the test result lies inside the *critical region* (i.e. outside the bounds), the null hypothesis is rejected. The points at which the *critical region* begins are also referred to as reject limits.

9.28. Selection probability. In general, the probability of selecting one or more defective items in a sample or the probability of performing an action capable of detecting indicators of an event (of interest) while evidence of the event is detectable.

For sampled items, the *selection probability* is most easily calculated as $(1 - \beta)$ where β is the probability of selecting zero defective items in the sample, which can be calculated using the hypergeometric distribution. The selection probability for performing an action capable of detecting events is calculated on the basis of the frequency of performing the action and the persistence times associated with evidence of the events having occurred.

9.29. Identification probability. The probability that the measurement method identifies that a defective item is in fact defective. This is usually calculated by assuming that the measurements are normally distributed with a known standard deviation. The *identification probability* in the context of detecting events is based on the effectiveness of the action performed during the persistence times of the events (times over which evidence of the events is detectable) in detecting that the events have occurred (e.g. the probability of detecting a given type of *misuse* in a *facility* during a *random inspection*).

9.30. Detection probability. The probability of being able to identify an event of safeguards interest (e.g. the diversion of 1 *significant quantity (SQ)* of *nuclear material* into *material unaccounted for (MUF)*). In the context of sampling, *detection probability* is the probability of selecting one or more defective items in a sample and correctly identifying by measurement that one or more of those selected *defects* is defective. *Detection probability* combines *selection probabilities* and *identification probabilities*.

9.31. False alarm probability. The probability α that statistical analysis of *nuclear material accountancy* and verification data indicate that a quantity of *nuclear material* is missing when, in fact, no diversion has occurred (i.e. α represents the probability of a *type I error*). For *nuclear material accountancy* verification purposes, α (or the associated *critical region*) is selected prior to performing statistical tests in order to minimize the number of *discrepancies* or false *anomalies* that must be investigated and is therefore generally set to a small value (e.g. 1 %).

9.32. Verification level. The selected confidence level $(1 - \beta)$ when applying the IAEA *sample size* formula, where $(1 - \beta)$ is the desired *detection probability*. Common verification levels are random low, medium and high (with $(1 - \beta)$ = 0.2, 0.5 and 0.9, respectively). Note that the achieved *detection probability* when applying a given verification level is not necessarily as large as $(1 - \beta)$, because it also depends on the *identification probabilities* of the applied verification method(s).

9.33. Sampling plan. In the context of *IAEA safeguards*, the calculation of necessary *sample sizes* for a given verification situation. Depending on the verification requirements, commonly used *sampling plans* include the following:

(a) Nested: distributing the total *sample size* among two or three different verification methods, where the number of the most precise measurements taken is minimized while applying a given *verification level* for sampling.
(b) Optimized: determining the *sample size* on the basis of verification requirements and constraints placed on the number of verifications with given verification methods that may be performed during an *inspection*.
(c) Two stage: calculating *sample sizes* for efficient verification of multiple items found in containers or subunits (e.g. fuel assemblies in baskets).
(d) Follow-up: an additional *sampling plan* calculated when one or more *defects* are identified as *defects* using the original *sampling plan*.

9.34. Variable sampling in the attribute mode. The results of quantitative measurements are used only to decide whether or not the item measured meets a specified criterion, which is a 'yes/no' decision.

9.35. Variable sampling in the variable mode. The results of quantitative measurements are used quantitatively in further analysis (e.g. in statistical tests of *operator–inspector differences* or in establishing the *D statistic*).

9.36. Relative standard deviation (RSD). The *relative standard deviation*, or coefficient of variation, is defined as $\delta = \sigma/\mu$, where μ is the mean and σ is the standard deviation of the population distribution. *RSD* is often expressed as a percentage. In the *IAEA safeguards* context, *RSD* usually refers to relative *measurement error* standard deviations.

9.37. Measurement uncertainty. A non-negative parameter characterizing the dispersion of the values that could be attributed to a measured quantity. All measurements are subject to uncertainty, and a measurement result is complete only when it is accompanied by a statement of the associated uncertainty. This uncertainty has a probabilistic basis and reflects incomplete knowledge of the quantity value. Uncertainty is usually expressed as a multiple of the standard deviation of the total *measurement error*, which can include both *random errors* and *systematic errors*.

9.38. Statistical sample. A set of items selected from a population of items (e.g. cylinders of UF_6) using a defined procedure. The types of sampling procedure may include the following:

(a) Random sampling: sampling based on the random selection of items, which ensures equal probability of selection for each item in the population.

(b) Systematic sampling: sampling based on the selection of items according to a fixed interval (e.g. every fifth item).

10. VISITS AND ACTIVITIES IN THE FIELD

Safeguards visits and activities in the field — including inspections and design information verification (DIV) — are carried out by the IAEA in accordance with the provisions of the relevant safeguards agreement. For a State that also has an additional protocol (AP) in force, the IAEA may also conduct complementary access in that State, as necessary.

10.1. Visit. The presence of the IAEA in a State for a safeguards *inspection*, *design information verification (DIV)*, *complementary access* or other safeguards related activities (which may take place at *locations* other than facilities or *locations outside facilities (LOFs)*).

Examples of other safeguards related activities include the maintenance or installation of *safeguards equipment*; fact finding and technical discussions in connection with the development of *safeguards approaches*; and negotiations and discussions with *facility* and State authorities regarding safeguards implementation matters. The term *'visit'* is relevant to all types of *safeguards agreements* and protocols thereto. Some *visits* are counted as *calendar-days in the field for verification (CDFVs)*.

10.2. Design information verification (DIV). Activities carried out by the IAEA at a *facility* to verify the correctness and completeness of the *design information* provided by the State.

An initial *DIV* is performed on a newly built *facility* to confirm that the as-built *facility* is as declared. A *DIV* is performed periodically on existing *facilities* to confirm the continued validity of the *design information* and of the *safeguards approach*. The IAEA's authority for performing a *DIV* is a continuing right throughout all phases of a *facility's* lifetime until the *facility* has been verified by the IAEA as *decommissioned for safeguards purposes*.

10.3. Inspection. A *safeguards measure* comprising a set of activities carried out by *IAEA inspectors* under a *safeguards agreement* ([153] or [66]) to verify that *nuclear material* subject to *IAEA safeguards* remains in peaceful activities or is otherwise adequately accounted for. Under [66], *inspections* also include verification of other items such as non-nuclear material, *facilities*, equipment, services and information (referred to as a design review). Examples of *inspections* are described in terms 10.4–10.14.

10.4. Initial inspection. Paragraph 51 of [66] provides that an *initial inspection* may be carried out, if so provided in a *safeguards agreement*, to verify that the construction of a principal nuclear *facility* is in accordance with the design reviewed by the IAEA. The *initial inspection* may be carried out as soon as possible after the *facility* has come under *IAEA safeguards*, in the case of a *facility* already in operation, or before the *facility* starts to operate, in the other cases.

10.5. Ad hoc inspection. An *inspection* performed by *IAEA inspectors* under para. 71 of [153], which provides that the IAEA may make *ad hoc inspections* as follows:

(a) To verify the information contained in the *initial report* on the *nuclear material* subject to *IAEA safeguards* under the agreement;
(b) To identify and verify changes in the situation which have occurred since the date of the *initial report*;
(c) To identify and, if possible, verify the quantity and composition of *nuclear material* before its transfer out of or upon its transfer into the State.

10.6. Routine inspection. An *inspection* performed by *IAEA inspectors* under para. 72 of [153], which provides that the IAEA may perform *routine inspections* at a *facility* or *location outside facilities (LOF)* as follows:

(a) To verify that reports are consistent with records;
(b) To verify the *location*, identity, quantity and composition of all *nuclear material* subject to safeguards under the agreement;
(c) To verify information on the possible causes of *material unaccounted for (MUF)*, *shipper/receiver differences (SRDs)* and uncertainties in the *book inventory (BI)*.

According to para. 49 of [66], *routine inspections* may include the following, as appropriate:

(a) Audit of records and reports;
(b) Verification of the amount of safeguarded *nuclear material* by physical *inspection*, measurement and sampling;
(c) Examination of principal nuclear *facilities*, including a check of their measuring instruments and operating characteristics;
(d) Check of the operations carried out at principal nuclear facilities and at research and development *facilities* containing safeguarded *nuclear material*.

10.7. Unannounced inspection. A *routine inspection* performed by *IAEA inspectors* at a *facility* for which no advance notice is provided by the IAEA to the State before the arrival of *IAEA inspectors*. Paragraph 84 of [153] provides that, “as a supplementary measure, the Agency may carry out without advance notification a portion of the routine inspections...in accordance with the principle of random sampling.” Paragraph 50 of [66] makes provision for the IAEA to carry out unannounced *inspections*.

10.8. Short notice inspection. A *routine inspection* performed by *IAEA inspectors* at a *facility* or *location outside facilities (LOF)* for which less advance notice is provided by the IAEA to the State than that provided for under para. 83 of [153].

10.9. Random inspection. A *routine inspection* performed by *IAEA inspectors* at a *facility* or *location outside facilities (LOF)* on a date chosen randomly.

10.10. Short notice random inspection (SNRI). A *routine inspection* performed by *IAEA inspectors* both at short notice and randomly. *SNRIs* are part of a *safeguards approach* developed for *fuel fabrication plants* under *IAEA safeguards* to provide 100% verification coverage of domestic transfers of nuclear material and borrowing scenarios. The *SNRI* is based on near real time submittal of *mailbox declarations* containing the operator’s operational data. *SNRIs* may also be used at other *facility* types where the *safeguards approach* calls for unpredictably scheduled *short notice inspections*.

10.11. Limited frequency unannounced access (LFUA). A *routine inspection* carried out by *IAEA inspectors* at gas centrifuge *uranium enrichment plants* under *IAEA safeguards* in a State with an *INFCIRC/153-type safeguards agreement* and operating at a declared *uranium enrichment* level of 5% or less. *LFUA routine inspections* carried out in cascade areas are designed to permit, together with *inspection activities* outside cascade areas, the timely detection of the diversion of 1 *significant quantity (SQ)* of *uranium*, including the production of 1 *SQ* of *uranium* at an *enrichment* level higher than that declared, while protecting the sensitive technical information related to the *enrichment* process. The *LFUA*, inter alia, secures access at short notice for *IAEA inspectors* to the cascade area of the plant concerned. *Inspection activities* to be implemented within the cascade area include visual observation; radiation monitoring and *non-destructive assay (NDA)* measurements; *environmental sampling (ES)* and *nuclear material* sampling; and application and verification of *seals*. The activities to be performed and the frequency of access to the cascade area depend on the design and operational features of the plant.

10.12. Simultaneous inspections. *Inspections* performed by *IAEA inspectors* simultaneously or within a short period of time at two or more *facilities* in a State in order to detect possible diversions arranged in collusion between *facilities* by, for example, the temporary transfer ('borrowing') of *nuclear material* between *facilities* so that the same *nuclear material* is counted twice by the IAEA, once in each of the two *facilities* inspected. The facilities may be of the same type (e.g. light water reactors using fuel assemblies of the same kind) or they may be linked in the same *nuclear fuel cycle* (e.g. light water reactors, *fuel fabrication plants* and *reprocessing plants*, spent fuel storage areas). *Simultaneous inspections* at *fuel fabrication plants* may be replaced by *short notice random inspections* (*SNRIs*).

10.13. Continuous inspection. Activities that enable the IAEA to maintain continuity of knowledge concerning *inventory* and flow of *nuclear material* by witnessing key operations, recording measurement and operating data, and verifying the information in order to meet the safeguards objectives. The activities involved may or may not require the continuous presence of an *IAEA inspector* or *inspectors* within the *facility*. According to para. 80 of [153], for *facilities* handling large amounts of *plutonium* or *high enriched uranium (HEU)*, the *inspection* effort foreseen may in practice allow for *continuous inspection*. Provisions for *continuous inspections* under *item-specific safeguards agreements* are given in Annexes I and II to [66].

10.14. Special inspection. An *inspection* is deemed to be special when it is either additional to the *routine inspection* effort provided for in paras 78–82 of [153], or involves access to information or *locations* in addition to the access specified in para. 76 of [153] for ad hoc and *routine inspections*, or both. Paragraph 73 of [153] provides that the IAEA may conduct *special inspections*, subject to the procedures for consultations between the State and the IAEA, in order to verify the information contained in *special reports*, or if the IAEA considers that information made available by the State, including explanations from the State and information obtained from *routine inspections*, is not adequate for the IAEA to fulfil its responsibilities under the agreement. In case action by the State is essential and urgent, para. 18 of [153] applies.

According to paras 53 and 54 of [66], the IAEA may carry out *special inspections* if the study of a report indicates that such an *inspection* is desirable or any unforeseen circumstance requires immediate action. The IAEA may also carry out *special inspections* if substantial amounts of safeguarded *nuclear material* are to be transferred outside the jurisdiction of the State in which it is being safeguarded, for which purpose the State shall give the IAEA sufficient advance notice of any such proposed transfer.

10.15. Access for inspection. Paragraph 76 of [153] provides that *IAEA inspectors* have access as follows:

(a) For the purposes of verifying the information contained in the *initial report* and identifying and verifying changes in the situation which have occurred since the date of the *initial report*, as specified in paras 71(a) and 71(b) of [153], and until such time as the *strategic points* have been specified in the *subsidiary arrangements*, *IAEA inspectors* shall have access to any *location* where the *initial report* or any *inspections* carried out in connection with it indicate that *nuclear material* is present.

(b) For the purposes of identifying and verifying the quantity of *nuclear material* prior to or following transfer into or out of the State, as specified in para. 71(c) of [153], *IAEA inspectors* shall have access to any *location* of which the IAEA has been notified in accordance with para. 92(c) or para. 95(c) of [153].

(c) For the purposes of verifying the consistency of records and reports; verifying the *location*, identity, quantity and composition of all *nuclear material* subject to *IAEA safeguards*; and verifying information on the possible causes of *material unaccounted for (MUF)*, *shipper/receiver differences (SRDs)* and uncertainties in the *book inventory (BI)*, as specified in para. 72 of [153], *IAEA inspectors* shall have access only to the *strategic points* specified in the *subsidiary arrangements* and to the records maintained pursuant to paras 51–58 of [153].

(d) In the event of the State concluding that any unusual circumstances require extended limitations on access by the IAEA, the State and the IAEA shall promptly make arrangements with a view to enabling the IAEA to discharge its safeguards responsibilities in the light of these limitations. The IAEA Director General shall report each such arrangement to the IAEA Board of Governors.

According to para. 77 of [153], in circumstances which may lead to a *special inspection*, the State and the IAEA shall consult forthwith. As a result of such consultations, the IAEA may undertake *inspections* in addition to the *routine inspection* effort provided for under paras 78–82 of [153], and may obtain access in agreement with the State to information or *locations* in addition to the access specified under para. 76 of [153] for *ad hoc inspections* and *routine inspections*.

Under *item-specific safeguards agreements*, para. 9 of the Annex to [39] provides that *IAEA inspectors* shall have access to all materials, equipment and *facilities* to which *IAEA safeguards* are applied.

10.16. Scope of inspection. Paragraph 74 of [153] provides that for purposes of *ad hoc inspections*, *routine inspections* and *special inspections* performed under *INFCIRC/153-type safeguards agreements*:

> "the Agency may:
>
> (a) Examine the records kept…;
> (b) Make independent measurements of all *nuclear material* subject to safeguards under the Agreement;
> (c) Verify the functioning and calibration of instruments and other measuring and control equipment;
> (d) Apply and make use of surveillance and containment measures; and
> (e) Use other objective methods which have been demonstrated to be technically feasible."

Activities which the IAEA shall be enabled to perform within the *scope of inspection* are reflected in para. 75 of [153] and in the relevant *subsidiary arrangements*. The scope of a *routine inspection* under an *item-specific safeguards agreement* is described in para. 49 of [66].

10.17. Frequency of inspection. The number of times per year that a *facility* or a *material balance area (MBA)* outside a *facility* may be inspected. Under an *INFCIRC/153-type safeguards agreement*, the frequency of *routine inspections* at *facilities* and *MBAs* outside *facilities* with a content or *annual throughput* (whichever is greater) not exceeding 5 *effective kilograms (ekg)* may not exceed one *inspection* per year [153, para. 79]. In all other cases, inspection frequency is related to the IAEA timeliness detection goals for the *nuclear material* considered. According to para. 78 of [153], the number, intensity, duration and timing of *routine inspections* shall be kept to the minimum consistent with the effective implementation of *IAEA safeguards*. For *inspections* under an *item-specific safeguards agreement*, see [66], para. 57 and Annexes I and II.

10.18. Advance notice of inspections. A notification provided by the IAEA to the State or regional authority relative to *inspections* as provided for under a *safeguards agreement*. Under an *INFCIRC/153-type safeguards agreement*, for example, advance notice for *routine inspections* is at least 24 hours for *facilities* involving *plutonium* or *uranium* enriched to more than 5% and one week in all other cases [153, para. 83(c)]. However, according to para. 84 of [153], the IAEA may carry out without advance notice a portion of the *routine inspections* provided for in para. 80 of [153].

10.19. Inspection activities. Verification activities performed by *IAEA inspectors* during and in connection with *inspections* at *facilities*. Under an *INFCIRC/153-type safeguards agreement* (see [153], para. 74), activities may include *nuclear material accounting* activities, *nuclear material* measurements, verification of instruments and control equipment, the application of *containment/surveillance measures*, and other activities such as *environmental sampling (ES)*.

10.20. IAEA inspector. An IAEA official appointed by the IAEA Director General and approved by the IAEA Board of Governors to perform *inspections* and other verification activities in a State pursuant to the State's *safeguards agreement* and protocols thereto, as applicable. After approval by the Board, the inspector is proposed to the respective States in which they are expected to perform official duties. If the State agrees, the IAEA effects the designation. For States with an *additional protocol (AP)* in force, the designation procedure is provided for in Article 11 of [540]. All States are required under their respective *safeguards agreements* to grant *IAEA inspectors* privileges and immunities necessary for the performance of their functions, as foreseen in [9].

10.21. Calendar-days in the field for verification (CDFVs). The number of calendar-days spent performing *inspections*, *complementary accesses* and *design information verification (DIV)* at *facilities* and information verification at *locations outside facilities (LOFs)*, and the associated travel and rest periods.

10.22. Person-day of inspection (PDI). "[A] day during which a single inspector has access to a *facility* at any time for a total of not more than eight hours" [153, para. 109]. This legal definition does not necessarily coincide with a calendar day and is used to calculate the total amount of inspection effort at *facilities* compared with the *maximum routine inspection effort (MRIE)*. Where *inspection activities* require only a small portion of a calendar day, this still constitutes 1 *PDI*.

10.23. Person-year of inspection. According to para. 109 of [153], a *person-year of inspection* is equivalent to 300 *person-days of inspection (PDIs)*. However, the term 'inspector-year' (365 days minus weekend days and minus some allowance for leave) is used to reflect the average number of days in a calendar year during which an *IAEA inspector* is available for work.

10.24. Actual routine inspection effort (ARIE). The estimated annual inspection effort for a *facility* under an *INFCIRC/153-type safeguards agreement*, expressed in *person-days of inspections (PDIs)* and included in the *subsidiary arrangements*. For estimating *ARIE*, it is assumed that the *facility* operates according to its design data. In accordance with para. 81 of [153], due consideration should be given to the following when the *ARIE* and other elements of a *routine inspection* at a *facility* are being established:

(a) The form and accessibility of the *nuclear material*;
(b) The effectiveness of the *State (or regional) system of accounting for and control of nuclear material* (*SSAC/RSAC*) and the extent to which the operator is functionally independent of the *SSAC/RSAC*;
(c) The characteristics of the State's *nuclear fuel cycle*, in particular the number and types of *facilities* and the characteristics of such *facilities* relevant to safeguards;
(d) The international interdependence of nuclear activities involved and any relevant IAEA verification activities;
(e) Technical developments in the field of safeguards.

The *ARIE* is an estimate to be used as a guideline. Operational conditions and unforeseen situations may require certain deviations from the agreed *estimate*.

10.25. Planned actual routine inspection effort (PLARIE). The estimated annual *routine inspection* effort which, in contrast to the *actual routine inspection effort* (*ARIE*), takes into account the expected operational status of the *facility* (e.g. extended shutdowns). The *PLARIE* for a *facility* in most cases is smaller than the *ARIE*. The total *PLARIE* forecast for all facilities under *IAEA safeguards*, corrected by a factor that accounts for the total *inspection* resources available, serves as a basis for human resource allocation.

10.26. Maximum routine inspection effort (MRIE). The maximum number of *person-days of inspection (PDIs)* per annum allowable for a *facility*, as provided for under para. 80 of [153]. The limit depends on whichever is the largest of the *inventory*, *annual throughput* and maximum potential annual production of *nuclear material* of the *facility*. This largest quantity (*L*) is measured in *effective kilograms (ekg)* [153, para. 104]. For all types of *nuclear installation* with *L* less than 5 *ekg*, the maximum effort is one *routine inspection* per annum. For other facilities, the *inspection* regime shall be no more intensive than is necessary but shall be sufficient to maintain continuity of knowledge of the flow and *inventory* of *nuclear material*. For reactors and sealed stores, the limit is 50 *PDI*/a. In the case of *facilities* containing *plutonium* and *uranium* enriched to more than 5%, the equation $MRIE = 30 \times \sqrt{L}\ PDI/\mathrm{a}$ applies, but the *MRIE* should not be less than 450 *PDI*/a. For all other cases, an *MRIE* equal to (100 + 0.4*L*) *PDI*/a is specified.

10.27. Complementary access. Access provided by the State and carried out by *IAEA inspectors* in accordance with the provisions of an *additional protocol (AP)*. According to Article 4 of [540], the IAEA shall not mechanistically or systematically seek to verify the information provided by the State under Article 2 of its *AP*. However, the IAEA shall have access to the following:

(a) Any *location* referred to in Article 5.a.(i) or 5.a.(ii) of [540] on a selective basis in order to ensure the absence of undeclared *nuclear material*;
(b) Any *location* referred to in Article 5.b. or 5.c. to resolve a question relating to the correctness and completeness of the information provided by the State pursuant to Article 2, or to resolve an inconsistency relating to that information;
(c) Any *location* referred to in Article 5.a.(iii) to the extent necessary for the IAEA to confirm, for *IAEA safeguards* purposes, the declaration of the decommissioned status of a *facility* or *location outside facilities (LOF)* where *nuclear material* was customarily used.

In certain cases where the State is unable to provide the required access, it should make every reasonable effort to satisfy the IAEA's requirements, without delay, through other means and/or at adjacent *locations*, depending on the context [540, Articles 5.b, 5.c and 9].

Under Article 9, the State shall provide the IAEA with access to *locations* specified by the IAEA to carry out *wide area environmental sampling*. However, the IAEA shall not seek such access until the use of such *wide area enrvironmental sampling* and the procedural arrangements therefor have been approved by the IAEA Board of Governors and following consultations between the IAEA and the State.

Under Article 8 of [540], the State may offer the IAEA access to or request the IAEA to perform verification activities at a particular *location* in addition to those referred to in Articles 5 and 9.

10.28. Managed access. Upon the request of the State, the IAEA and the State shall make arrangements for *managed access*, arranged in such a way as:

> "to prevent the dissemination of proliferation sensitive information, to meet safety or physical protection requirements, or to protect proprietary or commercially sensitive information. Such arrangements shall not preclude the Agency from conducting activities necessary to provide credible assurance of the absence of *undeclared nuclear material and activities* at the location in question, including the resolution of a question relating to the

> correctness and completeness of the information referred to in Article 2 or of an inconsistency relating to that information" [540, Article 7.a].

The State may, when providing information pursuant to Article 2, "inform the Agency of the places at a *site* or location at which managed access may be applicable" [540, Article 7.b].

10.29. Location. In the context of [540], the term *'location'* usually means any geographical point or area described in the information supplied by a State or specified by the IAEA. ('*Location outside facilities (LOF)*' under INFCIRC/153 is equivalent to 'other location' under INFCIRC/66.)

10.30. Site. An area delimited by the State in the relevant *design information* for a *facility*, including a *closed-down facility*, and in the relevant information on a *location outside facilities (LOF)* where *nuclear material* is customarily used, including a *closed-down LOF* where *nuclear material* was customarily used (this is limited to *locations* with hot cells or where activities related to conversion, *enrichment*, fuel fabrication or *reprocessing* were carried out). It also includes all installations collocated with the *facility* or *location* for the provision or use of essential services, including hot cells for processing irradiated material not containing *nuclear material*; installations for the treatment, storage and disposal of *waste*; and buildings associated with specified activities identified by the State under Article 2.a(iv) of its *additional protocol (AP)* based on [540].

10.31. Advance notice of complementary access. Notification given by the IAEA to the State as provided for in Articles 4.b and 4.c of [540] and in connection with the implementation of *complementary access* under Article 5 of [540]. Advance notice for *complementary access* is at least 24 hours, except for access to any place on a *site* that is sought in conjunction with *design information verification (DIV) visits* or *ad hoc inspections* or *routine inspections* on that *site*, for which the period of advance notice shall, if the IAEA so requests, be at least two hours but, in exceptional circumstances, may be less than two hours. Advance notice shall be in writing and specify the reasons for access and the activities to be carried out during such access.

10.32. Complementary access activities. According to Article 6 of [540], the activities the *IAEA inspectors* may perform for *complementary access* depend on the type of *location*. They include the following: visual observation; collection of *environmental samples*; utilization of radiation detection and measurement devices; application of *seals* and other identifying and *tamper indicating* devices specified in *subsidiary arrangements*; *examination of records* relevant to the quantities, origin and disposition of the material; examination of safeguards relevant production and shipping records; collection of *environmental samples*; and other objective measures which have been demonstrated to be technically feasible and the use of which has been agreed by the IAEA Board of Governors and following consultations between the IAEA and the State.

11. SAFEGUARDS INFORMATION AND EVALUATION

The IAEA has available to it a broad range of safeguards relevant information about the nuclear programmes of States, which it uses to perform safeguards State evaluations. All safeguards relevant information available to the IAEA about a State at the time of such evaluations is assessed in the context of the State's nuclear and nuclear related activities and capabilities, taking into account the State's undertaking under its safeguards agreement. These evaluations, and the independent review of their findings, are key elements of planning safeguards activities in a State and are fundamental to the process of deriving safeguards conclusions.

11.1. Safeguards relevant information. Information relevant for the implementation of *IAEA safeguards* which contributes to the drawing of soundly based *safeguards conclusions*. This information is collected, evaluated and used by the IAEA in exercising its rights and fulfilling its obligations under *safeguards agreements*. For all States, the IAEA collects and processes three types of safeguards relevant information:

(a) Information provided by the State itself (e.g. declarations and reports, including clarifications and amplifications at the IAEA's request, and voluntarily provided information);
(b) Information from *safeguards activities* conducted by the IAEA in the field and at IAEA Headquarters (e.g. *inspections*, *design information verification* (*DIV)*, *material balance evaluations*);
(c) Other relevant information (e.g. *open source information, third party information*).

The first two types of information make up the great majority of the information used for safeguards implementation. All information collected by the IAEA is subject to rigorous review and is processed through steps that include validation using well defined processes and relevant technical expertise and consistency analysis.

11.2. Initial report. Under an *INFCIRC/153-type safeguards agreement*, an official statement by the State on all *nuclear material* subject to *IAEA safeguards*, which is to be provided to the IAEA within 30 days of the last day of the calendar month in which the agreement enters into force [153, para. 62]. From the *initial report*, the IAEA establishes a unified *inventory* of all *nuclear material* (irrespective of its origin) for the State and maintains this *inventory* on the basis of subsequent reports and its verification activities. Under an *item-specific safeguards agreement*, the first *routine report* is considered equivalent to an *initial report*.

11.3. Routine report. Under an *item-specific safeguards agreement*, the set of *accounting reports* and *operating reports* made by the State to the IAEA [66, para. 39]. In accordance with para. 40 of [66], the first *routine report* is to be submitted as soon as there is any safeguarded *nuclear material* to be accounted for, or as soon as the nuclear *facility* to which it relates is in a condition to operate.

11.4. Accounting report. A report made by the State to the IAEA on the status of *nuclear material* subject to safeguards at a *material balance area (MBA)* and on the changes in that status since the previous report. *Accounting reports* are submitted by the State at times specified in the *safeguards agreement* or in the *subsidiary arrangements*. Under an *INFCIRC/153-type safeguards agreement*, reporting formats agreed between the State and the IAEA are described in *Code 10* of the *subsidiary arrangements*. Such agreements provide for three types of *accounting report*: *inventory change reports (ICRs)*, *material balance reports (MBRs)* and *physical inventory listings (PILs)*. Provision for *accounting reports* under an *item-specific safeguards agreement* is made in para. 39(a) of [66].

11.5. Inventory change report (ICR). An *accounting report* provided by the State to the IAEA "showing changes in the inventory of *nuclear material*. The reports shall be dispatched as soon as possible and in any event within 30 days after the end of the month in which the *inventory changes* occurred or were established" [153, para. 63(a)]. In accordance with para. 64 of [153]:

> "*inventory change* reports shall specify identification and *batch data* for each *batch* of *nuclear material*, the date of the *inventory change* and, as appropriate, the originating *material balance area* and the receiving *material balance area* or the recipient. These reports shall be accompanied by *concise notes*".

11.6. Concise notes. According to para. 64 of [153], information supplied by the State to the IAEA and accompanying *inventory change reports (ICRs)* for the purposes of explaining changes in the *inventory* (on the basis of the operating data contained in the *operating records*) and describing the anticipated operational programme, particularly the taking of a *physical inventory*.

11.7. Material balance report (MBR). According to para. 63(b) of [153], an *accounting report* provided by the State to the IAEA:

> "showing the material balance based on a *physical inventory* of *nuclear material* actually present in the *material balance area*. The reports shall be dispatched as soon as possible and in any event within 30 days after the *physical inventory* has been taken".
>
> According to para. 67 of [153]:
>
> "the material balance reports shall include the following entries, unless otherwise agreed by the Agency and the State:
>
> (a) Beginning physical inventory;
> (b) Inventory changes (first increases, then decreases);
> (c) Ending book inventory;
> (d) Shipper/receiver differences;
> (e) Adjusted ending book inventory;
> (f) Ending physical inventory; and
> (g) Material unaccounted for."

An *MBR* must be submitted even where there was no *nuclear material* in the *material balance area (MBA)* at the time of the *physical inventory* taking and where no *inventory changes* occurred during the relevant *material balance period (MBP)*, as long as the *MBA* continues to be subject to *IAEA safeguards*.

11.8. Physical inventory listing (PIL). A report provided by the State to the IAEA in connection with a *physical inventory* taking by the operator "listing all *batches* separately and specifying material identification and *batch data* for each *batch*" [153, para. 67]. Such listings are to be attached to each *material balance report (MBR)* even where there was no *nuclear material* in the *material balance area (MBA)* at the time of the ending of the *physical inventory* taking.

11.9. Operating report. A report by the State to the IAEA on the operation of a *facility* in connection with the use and handling of *nuclear material*. *Operating reports* are submitted for *facilities* safeguarded under *item-specific safeguards agreements*; the requirement is provided in para. 39(b) of [66].

11.10. Special report. In accordance with para. 68 of [153], a report by the State to the IAEA on the loss of *nuclear material* exceeding specified limits or in the event that *containment/surveillance measures* have been unexpectedly changed from those specified in the *subsidiary arrangements*. *Item-specific safeguards agreements* also require *special reports* to be submitted in the event that a transfer of *nuclear material* results in a significant change in the *inventory* of a *facility*; the requirement is reflected in paras 42 and 43 of [66].

11.11. Mailbox declaration. The near real time submittal, into a secure electronic mailbox, of information on operational activities of safeguards relevance, as agreed in advance with the IAEA. *Mailbox declarations* are not used for submitting State reports to the IAEA, but are used for collecting and transmitting operator data, typically to facilitate *inspections* on short notice (e.g. through the use of *short notice random inspections* (*SNRIs*)).

The contents of the information submitted in *mailbox declarations* are agreed between the IAEA and the *State or regional authority responsible for safeguards implementation* (*SRA*) in coordination with the *facility* operator on a case by case basis. For example, a fuel fabrication *facility* operator might submit *mailbox declarations* with information on receipts, material in process, product and shipments of *nuclear material* on a daily basis. Provision of a *mailbox declaration* may also be provided in connection with declarations submitted pursuant to Article 2.a.(ii) of [540], although an *additional protocol (AP)* is not required for *mailbox declarations* to be provided to the IAEA.

11.12. Notification of transfers.

(a) Under an *INFCIRC/153-type safeguards agreement*, para. 92 of [153] provides that any intended transfer out of the State of safeguarded *nuclear material* in an amount exceeding 1 *effective kilogram (ekg)*, or by successive shipments to the same State within a period of three months each of less than 1 *ekg* but exceeding in total 1 *ekg*, shall be notified to the IAEA after the conclusion of the contractual arrangements leading to the transfer and normally at least two weeks before the *nuclear material* is to be prepared for shipping. For transfers into the State, similar provisions for notification are included in paras 95 and 96 of [153].
(b) The five nuclear-weapon States (as defined in Article IX.3 of the *Treaty on the Non-Proliferation of Nuclear Weapons (NPT)* [140]) have committed under INFCIRC/207 to provide the IAEA with advance *notifications of transfers* of *nuclear material* to non-nuclear-weapon States, as indicated in para. 1 of [207].
(c) Under para. 43 of [66], the State shall report to the IAEA, as soon as possible, and in any case within two weeks, any transfer not requiring advance notification that will result in a significant change in the quantity of safeguarded *nuclear material* in a *facility* or in a complex of *facilities* considered as a unit for this purpose by agreement with the IAEA.

11.13. Confirmation of transfers. Under an *INFCIRC/153-type safeguards agreement*, a requirement for the exporting State to make arrangements, if the *nuclear material* will not be subject to *IAEA safeguards* in the recipient State, for the IAEA to receive confirmation by the recipient State of the transfer [153, para. 94]. Further, the five nuclear-weapon States (as defined in Article IX.3 of the *Treaty on the Non-Proliferation of Nuclear Weapons (NPT)* [140]) that have a *voluntary offer agreement (VOA)* with the IAEA have undertaken to provide the IAEA with such confirmations of transfers from non-nuclear-weapon States, as indicated in para. 2 of [207].

11.14. Voluntary reports on nuclear material, specified equipment and non-nuclear material. Information provided to the IAEA by States participating in the *voluntary reporting scheme (VRS)*.

11.15. Declaration pursuant to an additional protocol. Information submitted to the IAEA by a State about its nuclear programme and related activities as required by Article 2 of [540]. Examples of such information are the research and development activities related to the State's *nuclear fuel cycle*, descriptions of buildings on *sites*, nuclear related manufacturing activities, and exports of specified equipment and non-nuclear material.

Additional protocol (AP) declarations include information about the State's *nuclear material* and *nuclear fuel cycle* which supplements the information submitted under the *comprehensive safeguards agreement (CSA)*. The *initial AP declaration, quarterly AP declarations* and *annual AP update declarations*, together with other declarations pursuant to Article 3 of an *AP*, help to improve the IAEA's understanding of the State's *nuclear fuel cycle* capabilities and activities.

11.16. Initial AP declaration. Information provided to the IAEA by the State within 180 days of the entry into force of its *additional protocol (AP)*, consisting of the information identified in Article 2.a.(i), 2.a.(iii)–2.a.(v), 2.a.(vi)(a), 2.a.(vii) and 2.a.(x) and Article 2.b.(i) (see Article 3.a of [540]). If a State has nothing to declare under a particular article, it should indicate this by stating 'nothing to declare' for that line of the declaration.

11.17. Annual AP update declaration. Annual updates to the information referred to in the *initial AP declarations*, *imports and exports* related to Article 2.a.(vi)(a), and changes in *location* related to Article 2.a(viii) by 15 May for the period of the previous calendar year (see Articles 3.b, 3.c and 3.e of [540]). If a State has nothing or no new information to declare under a particular article, it should indicate this by stating respectively 'nothing to declare' or 'no change' for that line of the declaration.

11.18. Quarterly AP declaration. Information provided, on a quarterly basis, by a State under Article 2.a.(ix)(a) of its *additional protocol (AP)* (see Article 3.d of [540]). This information shall be provided within 60 days of the end of each quarter. If a State has nothing to declare under a particular article, it should indicate this by stating 'nothing to declare' for that line of the declaration.

11.19. State Declarations Portal (SDP). A web based system supporting secure bidirectional information exchange between States and the IAEA.

Information shared through the *SDP* includes but is not limited to acknowledgement letters, *additional protocol (AP)* declarations, *design information questionnaires (DIQs)*, *nuclear material accounting reports*, and other types of State declaration and official communication.

11.20. Protocol Reporter. A software tool which facilitates the preparation of declarations by States pursuant to Articles 2 and 3 of the Protocol Additional to Safeguards Agreements (*additional protocol (AP)*). The system assists in the creation of declarations to the IAEA in electronic form.

11.21. Open source information. Information available to the public from sources external to the IAEA. Examples of open sources relevant to safeguards include, inter alia, the following:

(a) Government: for example, publicly available information from government entities that is relevant to nuclear policies, activities and plans for its nuclear programme and the management of *nuclear material* and nuclear *facilities*.
(b) Nuclear operators and manufacturers: for example, publicly available information from entities involved in activities such as the operation of nuclear *facilities*, development of *nuclear fuel cycle* technologies and manufacture of *nuclear fuel cycle* related equipment and material.
(c) Scientific and technical literature: for example, *safeguards relevant information* contained in academic and scientific publications, patents, presentations and conference proceedings which provides insight into *nuclear fuel cycle* technology and related research and development activities.
(d) Trade: for example, statistical and transactional records of *imports and exports* of *nuclear material* and *nuclear fuel cycle* related material and equipment.
(e) Satellite imagery: for example, images collected by satellites (remote sensing data from space-borne platforms) that are either freely available or procured from commercial vendors.

(f) Media: for example, *safeguards relevant information* published by news organizations or distributed by news monitoring services that is available in various forms, including electronic and print.

11.22. Third party information. Information made available to the IAEA by a State or other party (e.g. organizations, individuals), on a voluntary basis, relating to another State. Such information may include nuclear procurement related information collected by States (e.g. export denials) and information collected through national means.

11.23. Incident and Trafficking Database (ITDB). An international database maintained by the IAEA in cooperation with participating States. The *ITDB* contains authoritative information on incidents of illicit trafficking and other unauthorized activities and events involving nuclear and other radioactive material outside of regulatory control that are reported by participating States voluntarily.

11.24. Safeguards implementation issue. An issue identified by the IAEA in the course of safeguards implementation which requires clarification or follow-up action. Each *safeguards implementation issue* is assessed to determine whether it is a possible *anomaly* on the basis of the impact of the issue on the IAEA's ability to draw a *safeguards conclusion* for the State.

11.25. Discrepancy. An inconsistency found in the *facility* operator's records, or between *facility* records and State reports, or between these records and inspector observations or indications resulting from *containment* and *surveillance*. *Discrepancies* that cannot be resolved (i.e. ascribed to innocent causes or otherwise satisfactorily explained) may lead to the determination that declared *nuclear material* is unaccountably missing. A *discrepancy* involving a significant *inventory* difference arising from *material balance evaluation* is classified as a possible *anomaly*.

11.26. Anomaly. An unusual observable condition which might result from *diversion of nuclear material* or *misuse* of safeguarded items, or another *safeguards implementation issue* which frustrates or restricts the ability of the IAEA to draw a *safeguards conclusion* for a State pursuant to its relevant *safeguards agreement*. Examples of possible *anomalies* include but are not limited to the following:

(a) Denial or restriction of IAEA access to information or *locations* to which the IAEA has a right of access under the *safeguards agreement* or the *additional protocol (AP)*, where applicable;
(b) Unreported safeguards significant changes to *facility* design or operating conditions;
(c) A significant *inventory* difference arising from *material balance evaluation*;
(d) A significant departure from the agreed recording and reporting system;
(e) Failure of the *facility* operator to comply with agreed measurement standards or sampling methods;
(f) Evidence of tampering with the Agency's *safeguards equipment*, including *containment/surveillance measures*;
(g) A question or inconsistency which has not been resolved through follow-up action in the process of *State evaluation*;
(h) Inability to attain an applicable safeguards objective in a State, regardless of the reason.

11.27. IAEA confidentiality regime. The regime for the protection against unauthorized disclosure of all confidential information that the IAEA acquires, including such information coming to the IAEA's knowledge in the implementation of *safeguards agreements* and of *additional protocols (APs)*. The regime reflects the requirements for the protection of confidential information as provided under Article 15 of [540].

11.28. State evaluation. The ongoing evaluation of all *safeguards relevant information* available to the IAEA about a State aimed at assessing the consistency of that information in the context of a State's safeguards obligations. *State evaluation* is conducted for the purposes of planning, conducting and evaluating *safeguards activities* and drawing soundly based *safeguards conclusions*.

11.29. State Evaluation Group (SEG). A group within the IAEA's Department of Safeguards which evaluates all *safeguards relevant information* available to the IAEA about a State and documents the results in a *safeguards State evaluation report*, including recommendations for IAEA Secretariat findings and *safeguards conclusions*. The *SEG* also performs *acquisition path analysis*, develops a *State-level safeguards approach (SLA)* and prepares an *annual implementation plan (AIP)* for individual States.

11.30. Safeguards effectiveness evaluation. A process of evaluating the extent to which the IAEA's implementation of safeguards is able to achieve the relevant safeguards objectives. For a State with a *State-level safeguards approach (SLA)*, the effectiveness evaluation considers whether the activities in the *annual implementation plan (AIP)* meet the objectives of the *SLA*, whether the planned activities were actually conducted and whether or not the activities were conducted in such a way as to achieve the *technical objectives* to the level planned. In the absence of an *SLA*, the factors considered in *safeguards effectiveness evaluation* include the quantitative findings from implementation of *nuclear material* verification activities, as prescribed by the *Safeguards Criteria*, as well as qualitative *safeguards relevant information* available about the State's nuclear and nuclear related activities, including *facility design information* and IAEA knowledge of *facility* operations.

11.31. Safeguards State evaluation report. An internal report documenting periodically the findings of the IAEA's safeguards evaluations performed for a State. The findings, to be documented in a State evaluation report, are independently reviewed by IAEA intradepartmental review committees.

11.32. Safeguards conclusions. Conclusions drawn by the IAEA on the basis of findings from its verification and *State evaluation* activities. Safeguards conclusions are drawn for each State with a *safeguards agreement* in force and are reviewed annually. These conclusions are reported for States in the *Safeguards Implementation Report (SIR)*.

12. REPORTING ON SAFEGUARDS IMPLEMENTATION

The IAEA uses various mechanisms for reporting to the IAEA Policy-Making Organs, States and relevant regional authorities on the implementation of safeguards and other verification activities.

12.1. Reporting on design information verification. Under an *INFCIRC/153-type safeguards agreement*, the IAEA sends a formal letter (also referred to as a *design information verification (DIV)* acknowledgement letter) to the State whenever the IAEA has performed *DIV* in that State. The letter may include, if relevant, a request for any amplification, clarification or *correction* of the information submitted by the State.

Under an *item-specific safeguards agreement*, para. 32 of [66] stipulates that the IAEA should complete its design review promptly and shall notify the State of its *safeguards conclusions* without delay.

12.2. Statement on Inspection Results (90(a) Statement). Paragraph 90(a) of [153] provides that the IAEA is obliged to report formally to the State at intervals specified in the *subsidiary arrangements* (usually within 60 days after each *inspection*) on the activities carried out at each *facility* and their results, including any *discrepancies* found and whether they have been resolved. This *Statement on Inspection Results*, which is referred to as a *90(a) Statement*, is provided to a State that has an *INFCIRC/153-type safeguards agreement* in force; it is of a preliminary nature because evaluation activities may not have been completed.

12.3. Statement on Conclusions (90(b) Statement). Paragraphs 30 and 90(b) of [153] state that the IAEA is obliged to report formally to the State on the technical conclusions drawn from its *nuclear material* verification activities for each *material balance area (MBA)* over a *material balance period (MBP)*. This *Statement on Conclusions*, which is referred to as a *90(b) Statement*, indicates, inter alia, the amount of *material unaccounted for (MUF)* over a specific period, as verified by the IAEA. The statement is made as soon as possible (a) after a *physical inventory* taking by the *facility* operator and verified by the IAEA and (b) after a material balance has been closed. The time limit of the reporting is specified in the *subsidiary arrangements* (usually within 60 days after the end of the month in which the IAEA has verified the *physical inventory*). This statement is provided to a State that has an *INFCIRC/153-type safeguards agreement* in force.

12.4. Book inventory statement. Under para. 66 of [153], the IAEA is obliged to provide the State with a semi-annual statement of the *book inventory (BI)* of *nuclear material* subject to *IAEA safeguards* for each *material balance area (MBA)*. The *BI* for the period covered by each such statement is based on the last *physical inventory listing (PIL)* and the subsequent *inventory change reports* (*ICRs)*. *Book inventory statements* do not imply verification by the IAEA of the data contained therein and are meant, inter alia, to be used by the *State (or regional) system of accounting for and control of nuclear material (SSAC/RSAC)* to check for any differences with the accounting data maintained by the *SSAC/RSAC*.

Similar statements are also provided under an *item-specific safeguards agreement*, if required by the specific agreement (as in the case of the annual official inventory (OFIN) statement), and to States with a *voluntary offer agreement* (*VOA)* in force.

12.5. Quarterly import communication. A communication prepared and dispatched by the IAEA to a State that has an *INFCIRC/153-type safeguards agreement* or a *voluntary offer agreement* (*VOA)* in force, indicating any unmatched foreign shipments and receipts of *nuclear material*. Issued on a quarterly basis, each 'import communication' to a State contains a list of those shipments to the State (as reported by other States) or those receipts in the State (as reported by the State itself) for which no match has been established. Import communications are meant to facilitate the interaction between the IAEA and the State so as to promptly resolve any unmatched foreign transfers. The IAEA has also established a 'de minimus quantity', set at approximately 0.002 *significant quantities (SQs)* for each *material type*, below which any unmatched *nuclear material* amounts are not included in the import communication.

12.6. Statement on domestic and international transfers (semi-annual transit matching statement). A statement made semi-annually by the IAEA to a State that has an *INFCIRC/153-type safeguards agreement* (referred to in Code 4.1.1 of the *subsidiary arrangements* (General Part)) or a *voluntary offer agreement* (*VOA)* in force. This statement covers, inter alia, the following:

(a) Domestic and foreign shipments reported by the State which the IAEA has been unable to match with information on receipts reported by the State (for domestic transfers) or by other States (for exports from the State);
(b) *Domestic receipts* reported by the State and foreign receipts (imports) reported by other States which the IAEA has been unable to match with shipments reported by the State.

The IAEA has also established a ‘de minimus quantity’, set at approximately 0.002 *significant quantities (SQs)* for each *material type*, below which any unmatched *nuclear material* amounts are not included in this statement.

12.7. Statement of timeliness in reporting. A statement, also known as the ‘statement on operation of report system’, provided by the IAEA semi-annually to each State that has an *INFCIRC/153-type safeguards agreement* (see Code 4.1.2 of the *subsidiary arrangements* (General Part)) or a *voluntary offer agreement* (*VOA)* in force, which includes information on any reporting delays. The statement is provided separately for each of the *nuclear material accounting reports* (i.e. *inventory change report (ICR), material balance report (MBR)* and *physical inventory listing (PIL)*).

12.8. Reporting on inspections under an item-specific safeguards agreement. Information, in the form of a letter, provided to a State by the IAEA after each *inspection* carried out under an *item-specific safeguards agreement*. The letter, which is referred to as an ‘INFCIRC/66 verification statement’, informs the State of the results of the *inspection*, as foreseen in para. 12 of the Annex to [39], and of any design review activities, if performed.

12.9. Statements under an AP. Under Article 10 of [540], for a State with an *additional protocol (AP)* in force, the IAEA is obligated to inform the State of the following:

(a) The activities carried out under the *AP*, including those in respect of any questions or inconsistencies the IAEA had brought to the attention of the State, within 60 days of the activities being carried out [540, Article 10.a]. This statement is referred to as a ‘10.a Statement’.
(b) The results of activities in respect of any questions or inconsistencies the IAEA had brought to the attention of the State, as soon as possible but in any case within 30 days of the results being established by the IAEA [540, Article 10.b]. This statement is referred to as a ‘10.b Statement’.
(c) The conclusions the IAEA has drawn from its activities under the *AP*, provided annually [540, Article 10.c]. This statement, which is referred to as a ‘10.c Statement’, is prepared to support the timely completion of the *Safeguards Implementation Report (SIR)*.

12.10. Safeguards Implementation Report (SIR). The report presented annually by the IAEA Director General to the IAEA Board of Governors on implementation of *IAEA safeguards* during the preceding calendar year. The report includes, inter alia, the Safeguards Statement for the year concerned, in which the safeguards findings and *safeguards conclusions* are reported. It also contains detailed information on the application of IAEA safeguards and safeguards related developments for the year concerned.

12.11. IAEA Annual Report. The report of the IAEA Board of Governors to the General Conference of the IAEA. The report, which is available to the public, concerns the IAEA's activities during the preceding year, as required by the *Statute of the IAEA*, and includes a chapter on nuclear verification.

12.12. Director General's report on Strengthening the Effectiveness and Improving the Efficiency of Agency Safeguards. The report by the IAEA Director General to the IAEA General Conference describing the measures taken to strengthen the effectiveness and improve the efficiency of the *IAEA safeguards system*. Since 1992, the IAEA Director General has produced this report annually in response to requests contained in the relevant IAEA General Conference resolutions.

13. STATE AND REGIONAL AUTHORITIES, RESPONSIBILITIES, SUPPORT AND SERVICES

States and relevant regional entities (such as the Brazilian–Argentine Agency for Accounting and Control of Nuclear Materials (ABACC) or the European Atomic Energy Community (Euratom)) have responsibilities under their respective safeguards agreements and additional protocols (APs) which require organizational support at both the national and the international level. The IAEA assists States in identifying relevant knowledge, skills and tasks, and in strengthening the institutions which have responsibilities related to safeguards implementation. Furthermore, the IAEA works with States to provide support through various mechanisms and services.

13.1. State (or regional) system of accounting for and control of nuclear material (SSAC/RSAC). A national or regional system established under [153] under which the *State or regional authority responsible for safeguards implementation* (*SRA*) accounts for and controls *nuclear material*.

Detailed specifications relating to an *SSAC/RSAC* are contained in paras 31 and 32 of [153] and Code 2.1 of *subsidiary arrangements* (General Part), including that the *SSAC/RSAC* should be based on a structure of *material balance areas (MBAs)*, which provides for the establishment of measures such as the following:

(a) For measurement: a *measurement system* for determination of quantities of *nuclear material* received, produced, shipped, lost, otherwise removed from *inventory* or on *inventory*; guidance for the evaluation of the precision and accuracy of measurements and the estimation of *measurement uncertainty*; procedures for taking a *physical inventory*; and procedures for the evaluation of accumulations of unmeasured *inventory* and unmeasured losses.
(b) For accountancy: procedures for identifying, reviewing and evaluating differences in shipper/receiver measurements; a system of records and reports showing, for each *material balance area (MBA)*, the *inventory* of *nuclear material* and the changes in that *inventory*, including receipts into and transfers out of the *MBA*; procedures for the submission of reports to the IAEA in accordance with paras 59–65 and 67–69 of [153]; and provisions to ensure correct operation of the accounting procedures and arrangements.
(c) For control: existing legislation (e.g. laws, regulations, general administrative procedures) giving requirements for measurement and accountancy requirements at the *facility* or *location outside facilities (LOF)* level and assurances that such requirements are carried out correctly by

operators; requirements for records and reports, licensing or authorization of relevant activities and national *inspections*; and audits and independent measurements at *facilities/LOFs* to ensure compliance.

The basic obligation to establish and maintain an *SSAC* under para. 7 of [153] applies for all States with an *INFCIRC/153-type safeguards agreement* [153] in force. Provisions for an *SSAC* are not included in [66] but may be included in agreements based on [66] and/or related *subsidiary arrangements* if agreed by the parties. *SSAC/RSAC* refers to the entire system of accounting for and control of *nuclear material* administered by the *State or regional authority responsible for safeguards implementation (SRA)*.

13.2. State or regional authority responsible for safeguards implementation (SRA). The term *'SRA'* was introduced by the IAEA in 2012 to denote the authority established at the national (or regional) level to ensure and facilitate the implementation of *IAEA safeguards* in a State or States of a region. One of the primary responsibilities of an *SRA* is to establish and maintain a *State (or regional) system of accounting for and control of nuclear material (SSAC/RSAC)*. Such responsibility may also extend to the implementation of the State's obligations under an *additional protocol (AP)* [540].

The responsibilities of the *SRA* related to the implementation of *IAEA safeguards* may include *nuclear material accountancy* and the reporting of *imports and exports* of *nuclear material* as well as facilitating IAEA *inspections*. Where the *SRA* is responsible for activities associated with the implementation of an *AP* [540], such responsibilities may include, for example, coordinating the collection of information required to be reported to the IAEA in *AP* declarations, responding to IAEA requests for clarification and facilitating *complementary access* by the IAEA at relevant *locations*.

If established within a broader nuclear authority, the *SRA* may have additional responsibilities associated with nuclear safety, security, radiation protection and export/import controls separate from and in addition to its safeguards functions.

13.3. Safeguards infrastructure. A State's safeguards infrastructure is built on the foundation of a State and/or regional legislative and regulatory system, providing for oversight and management of *nuclear material* and activities. The safeguards infrastructure should allow for effective cooperation with the IAEA and address three fundamental areas:

(1) Establishment of laws, regulations and a system of accounting for and control of *nuclear material* at the national and/or regional level which

ensure that the requirements of the *safeguards agreement* and associated protocols and *subsidiary arrangements* are fully met;

(2) Provision of timely, correct and complete reports and declarations to the IAEA;

(3) Provision to the IAEA of support and timely access to *locations* and information necessary to achieve safeguards objectives.

13.4. Safeguards regulatory infrastructure. Laws and regulations which establish requirements regarding *nuclear material* possession, handling, use, *import and export*. The State's safeguards regulatory infrastructure addresses the following elements:

(a) Laws and safeguards specific regulations to control and oversee the use of *nuclear material* and nuclear related activities in the State, consistent with the State's obligations under its *safeguards agreement*;

(b) The assignment of responsibilities for *safeguards activities*, and the granting of legal authority to perform them, to an independent *State or regional authority responsible for safeguards implementation (SRA)*;

(c) The design and implementation of an effective *State (or regional) system of accounting for and control of nuclear material (SSAC/RSAC)*;

(d) The creation of an effective communication mechanism, including a point of contact, between the IAEA and the State;

(e) The implementation of procedures and practices necessary to facilitate information gathering, timely reporting and in-field verification.

13.5. IAEA Safeguards and SSAC Advisory Service (ISSAS). An IAEA peer review service established in 2004 to support the effective and efficient implementation of *IAEA safeguards* by identifying opportunities for enhancing *State systems of accounting for and control of nuclear material (SSACs)* and increasing cooperation between *State or regional authorities responsible for safeguards implementation (SRAs)* and the IAEA. The service involves an IAEA advisory service mission to the State to visit relevant institutions and meet with relevant technical, legal and policy personnel, providing a mechanism for identifying and disseminating good practices and lessons learned. Such a mission is carried out at the request of the State. The scope of an ISSAS mission is determined in consultation with the State and carried out by an IAEA led team of experts. The product of the mission includes a report drafted by the IAEA experts which addresses all the objectives of the mission, documents the team's findings and recommendations, and includes an action plan for follow-up by the State and the IAEA.

The objectives of an ISSAS mission are as follows:

(a) To evaluate the adequacy of the legal and regulatory framework and the administrative and technical systems of the *SSAC* at the State and *facility/location outside facility (LOF)* levels;
(b) To evaluate the performance of those systems in meeting the State's safeguards obligations pursuant to its *safeguards agreements* and protocols in force with the IAEA;
(c) To identify areas where further cooperation with the IAEA could increase the effectiveness or efficiency of safeguards implementation;
(d) To make recommendations and suggestions on how any gaps or weaknesses identified could be addressed to enhance the capabilities of the *SSAC*, while recognizing good practices identified in the course of the mission.

Guidance on ISSAS missions is provided in [IAEA-SVS-13].

13.6. Member State Support Programme (MSSP). A voluntary, structured collaboration between the IAEA and a Member State through which the former requests and obtains financial and/or in-kind extrabudgetary support to help make its nuclear verification activities more effective and efficient. Examples of support include, inter alia, in-kind contributions to host training courses for *IAEA inspectors*, equipment design and development to support verification activities, expert support to provide guidance related to the *nuclear fuel cycle*, and support for events such as the safeguards symposium.

13.7. Support Programme Information and Communication System (SPRICS). The administrative IT platform supporting the IAEA's *Member State Support Programme (MSSP)*. *SPRICS* stores safeguards requests for extrabudgetary support, *MSSP* decisions and administrative details of the extrabudgetary support.

13.8. Research and Development Plan. A publication, first issued in 2012 and updated periodically thereafter, describing the research and development (R&D) and other support needed by the IAEA to achieve its priority safeguards objectives. The *R&D Plan* provided a roadmap for external partners, primarily *Member State Support Programmes (MSSPs)*, to undertake R&D to address the IAEA's safeguards needs. In recognition of requirements that extend beyond R&D, the *R&D Plan* was replaced by the publication *Enhancing Capabilities for Nuclear Verification: Resource Mobilization Priorities (RMP)* in 2022.

13.9. Enhancing Capabilities for Nuclear Verification: Resource Mobilization Priorities (RMP). A publication identifying and communicating the set of capabilities to be developed or enhanced which are of the highest priority to the IAEA and are especially reliant on external support. The *RMP* replaces the *Research and Development Plan* and is intended to help stakeholders understand the context for the capabilities that are needed and their relation to strengthening the effectiveness and improving the efficiency and resilience of *IAEA safeguards*. The *RMP* guides the IAEA's safeguards collaborations with traditional and non-traditional partners and mobilizes resources for activities not funded through the IAEA's Regular Budget. External support includes research and development, financial resources and expertise.

13.10. Development and Implementation Support (D&IS) Programme for Nuclear Verification. A biennial publication for IAEA safeguards staff and external partners (e.g. *Member State Support Programmes (MSSPs)*) covering development and implementation plans that require extrabudgetary or other support from external and other partners to improve nuclear verification.

13.11. Integrated Nuclear Infrastructure Review (INIR). A holistic IAEA peer review to evaluate the status of infrastructure development in a country introducing nuclear power or expanding its nuclear power programme on the basis of the IAEA's 'Milestones Approach' (described in the IAEA publication Milestones in the Development of a National Infrastructure for Nuclear Power)[6]. Covering 19 infrastructure issues, including safeguards, the approach is intended to assist countries in identifying areas requiring further development to reach the corresponding Milestone.

13.12. Nuclear Power Support Group and Integrated Work Plan. The IAEA uses mechanisms agreed by the Nuclear Power Support Group (NPSG) to coordinate support to Member States considering or embarking on nuclear power programmes that have conducted a self-assessment of the status of their national infrastructure based on the IAEA methodology.[7] The IAEA establishes a 'core team' for each Member State, with representatives of all relevant IAEA organizational units. The team reviews the status of the Member State's infrastructure development on the basis of its most recent interactions with counterparts and coordinates planning for IAEA support.

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[6] INTERNATIONAL ATOMIC ENERGY AGENCY, Milestones in the Development of a National Infrastructure for Nuclear Power, IAEA Nuclear Energy Series No. NG-G-3.1 (Rev. 1), IAEA, Vienna (2015).

[7] INTERNATIONAL ATOMIC ENERGY AGENCY, Evaluation of the Status of National Nuclear Infrastructure Development, IAEA Nuclear Energy Series No. NG-T-3.2 (Rev. 1), IAEA, Vienna (2016).

The core team typically meets formally with the relevant Member State counterparts to review and update the integrated work plan (IWP) and country nuclear infrastructure profile (CNIP). The counterparts usually include senior representatives of the government, the nuclear regulatory body and the prospective nuclear power plant owner/operator.

13.13. Standing Advisory Group on Safeguards Implementation (SAGSI). Established in 1975, the *Standing Advisory Group on Safeguards Implementation* regularly provides the Director General of the IAEA with expert advice and recommendations on technical topics related to *IAEA safeguards*. *SAGSI* is composed of up to 20 members who are recognized experts in the area of safeguards. Members are appointed by the Director General and serve in their personal capacity.

13.14. Safeguards by design. The integration of safeguards considerations into the design process of a new or modified nuclear *facility* or *location outside facilities (LOF)* at any point in the life cycle — from initial planning through design, construction, operation, *waste* management and decommissioning. The goal of safeguards by design is the improvement of safeguards implementation by addressing potential efficiency and effectiveness issues early in the design process. Safeguards by design is a voluntary process that neither replaces a State's obligations for early provision of *design information* under its *safeguards agreement* nor introduces new safeguards requirements. See [NP-T-2.8], [NP-T-2.9], [NF-T-4.8], [NF-T-4.10], [NF-T-4.7], [NF-T-3.2] and [NF-T-3.1].

13.15. Safeguards Traineeship Programme. A ten month programme at the IAEA open to candidates from States with a limited *nuclear fuel cycle* or none at all. The objective of the programme is to increase the number of qualified candidates from developing countries for the position of safeguards inspector in the IAEA or in their national nuclear organization. The *Safeguards Traineeship Programme* is designed to enhance the technical skills and competence of the trainees relating to the implementation of *IAEA safeguards* and to broaden their knowledge of the peaceful applications of nuclear techniques and the implementation thereof in their respective States.

13.16. Brazilian–Argentine Agency for Accounting and Control of Nuclear Materials (ABACC). An intergovernmental organization with its own legal personality created in 1991 by virtue of the *Agreement between the Republic of Argentina and the Federative Republic of Brazil for the Exclusively Peaceful Use of Nuclear Energy*. The functions of *ABACC* are to administer and apply the Common System of Accounting and Control of Nuclear Materials (SCCC), whose aim is to verify that all *nuclear materials* in all nuclear activities of the States Party are not diverted to nuclear weapons or other nuclear explosive devices. This Agreement was signed and entered into force in 1991; it is reproduced in [395]. *ABACC* also performs functions under [435], which entered into force on 4 March 1994 and provides for, inter alia, the cooperation between *ABACC* and the IAEA.

13.17. European Atomic Energy Community (Euratom). Euratom was established in 1957 by the *Treaty Establishing the European Atomic Energy Community (Euratom Treaty)* to further European integration and tackle energy shortages through the peaceful use of nuclear power. It has the same members as the European Union (EU) and is governed by the European Commission (EC) and the European Council, operating under the jurisdiction of the European Court of Justice. *Euratom's* work includes safeguarding *nuclear material* and technology in the EU; facilitating nuclear related investment and research and development; and ensuring equal access to nuclear supplies as well as the correct disposal of nuclear *waste* and the safety of operations.

The application of *IAEA safeguards* in States party to the *Euratom Treaty* is governed by regulations adopted by institutions of the EU. The role of *Euratom* in maintaining the *regional system of accounting for and control of nuclear material (RSAC)* under relevant *safeguards agreements* with the IAEA is performed by the EC through its constituent institutions. The EC, acting in the capacity of *Euratom*, is responsible for accountancy and control of *nuclear material* subject to safeguards under *safeguards agreements* between *Euratom*, relevant *Euratom* States and the IAEA.

Under Annex III of the *additional protocol (AP)* to [193], States party to the *AP* to [193] may entrust to the EC implementation of certain provisions which under the AP are the responsibility of the States. Such States are known as *'side-letter States'*.

13.18. New partnership approach (NPA). An approach to implementing safeguards in the non-nuclear-weapons State members of the *European Atomic Energy Community (Euratom)* under [193], agreed between the IAEA and *Euratom* in 1992 and later adapted to the introduction of *integrated safeguards*. The approach provided for use of common *safeguards equipment* and *safeguards approaches*, joint scheduling of *inspections* and special arrangements for *inspection* work and data sharing by the two organizations. The purpose of the *NPA* was to enable the IAEA to economize on *safeguards equipment* and *inspection* efforts deployed in the relevant States while maintaining its ability to perform independent verification.

13.19. Side-letter States. States party to the *additional protocol (AP)* to [193] which have decided to entrust to the European Commission (EC) implementation of certain provisions which under the *AP* are the responsibility of the States. The EC acts on behalf of those States for purposes of the implementation of the *AP* to [193].

13.20. Safeguards guidance in the IAEA Services Series. Guidance issued in the IAEA Services Series which has no legal status but which seeks to enhance understanding of safeguards concepts, methods and practices by providing explanations and examples, and share implementation experiences and lessons learned. The latest safeguards guidance can be found on the IAEA web site.

TRANSLATION OF TERMS

1. LEGAL INSTRUMENTS AND OTHER DOCUMENTSRELATED TO IAEA SAFEGUARDS

الصكوك القانونية وسائر الوثائق المتعلقة بضمانات الوكالة الدولية للطاقة الذرية

与国际原子能机构保障有关的法律文书和其他文件

INSTRUMENTS JURIDIQUES ET AUTRES DOCUMENTS CONCERNANT LES GARANTIES DE L'AIEA

МЕЖДУНАРОДНО-ПРАВОВЫЕ И ДРУГИЕ ДОКУМЕНТЫ, ОТНОСЯЩИЕСЯ К ГАРАНТИЯМ МАГАТЭ

INSTRUMENTOS JURÍDICOS Y OTROS DOCUMENTOS RELACIONADOS CON LAS SALVAGUARDIAS DEL OIEA

GESETZLICHE GRUNDLAGE FÜR DIE IAEO-SICHERUNGSMAßNAHMEN UND ANDERE SACHBEZOGENE DOKUMENTE

IAEA保障措置に関連する法的文書及びその他の文書

1.1. Statute of the International Atomic Energy Agency

النظام الأساسي للوكالة الدولية للطاقة الذرية

国际原子能机构《规约》

Statut de l'Agence internationale de l'énergie atomique

Устав Международного агентства по атомной энергии

Estatuto del Organismo Internacional de Energía Atómica

Satzung der Internationalen Atomenergie-Organisation

国際原子力機関憲章

1.2. Treaty on the Non-Proliferation of Nuclear Weapons (or Non-Proliferation Treaty) (NPT)

معاهدة عدم انتشار الأسلحة النووية (معاهدة عدم الانتشار)

不扩散核武器条约

Traité sur la non-prolifération des armes nucléaires (ou Traité sur la non-prolifération, TNP)

Договор о нераспространении ядерного оружия (или Договор о нераспространении) (ДНЯО)

Tratado sobre la No Proliferación de las Armas Nucleares (o Tratado sobre la No Proliferación) (TNP)

Vertrag über die Nichtverbreitung von Kernwaffen (NVV)

核兵器の不拡散に関する条約（核兵器不拡散条約、NPT）

1.3. Treaty for the Prohibition of Nuclear Weapons in Latin America and the Caribbean (Tlatelolco Treaty)

معاهدة حظر الأسلحة النووية في أمريكا اللاتينية ومنطقة البحر الكاريبي (معاهدة تلاتيلولكو)

拉丁美洲和加勒比地区禁止核武器条约（特拉特洛尔科条约）

Traité visant l’interdiction des armes nucléaires en Amérique latine et dans les Caraïbes (Traité de Tlatelolco)

Договор о запрещении ядерного оружия в Латинской Америке и Карибском бассейне (Договор Тлателолко)

Tratado para la Proscripción de las Armas Nucleares en la América Latina y el Caribe (Tratado de Tlatelolco)

Vertrag von Tlatelolco über das Verbot von Kernwaffen in Lateinamerika und der Karibik (Vertrag von Tlatelolco)

ラテンアメリカ及びカリブ諸国核兵器禁止条約（トラテロルコ条約）

1.4. South Pacific Nuclear Free Zone Treaty (Rarotonga Treaty)

معاهدة إنشاء منطقة خالية من الأسلحة النووية في جنوب المحيط الهادئ (معاهدة راروتونغا)

南太平洋无核区条约（拉罗汤加条约）

Traité sur la zone dénucléarisée du Pacifique Sud (Traité de Rarotonga)

Договор о безъядерной зоне в южной части Тихого океана (Договор Раротонга)

Tratado sobre la Zona Libre de Armas Nucleares del Pacífico Sur (Tratado de Rarotonga)

Vertrag von Rarotonga über die kernwaffenfreie Zone im Süd-Pazifik (Vertrag von Rarotonga)

南太平洋非核兵器地帯条約（ラロトンガ条約）

1.5. Treaty on the Southeast Asia Nuclear Weapon-Free Zone (Bangkok Treaty)

معاهدة إنشاء منطقة خالية من الأسلحة النووية في جنوب شرق آسيا (معاهدة بانكوك)

东南亚无核武器区条约（曼谷条约）

Traité sur la zone exempte d’armes nucléaires de l’Asie du Sud-Est (Traité de Bangkok)

Договор о зоне, свободной от ядерного оружия, в Юго-Восточной

Азии (Бангкокский договор)
Tratado sobre el Establecimiento de una Zona Libre de Armas Nucleares en Asia Sudoriental (Tratado de Bangkok)
Vertrag von Bangkok über die kernwaffenfreie Zone in Südost-Asien (Vertrag von Bangkok)
東南アジア非核兵器地帯条約（バンコク条約）

1.6. African Nuclear-Weapon-Free Zone Treaty (Pelindaba Treaty)

معاهدة إنشاء منطقة خالية من الأسلحة النووية في أفريقيا (معاهدة بليندابا)
非洲无核武器区条约（佩林达巴条约）
Traité sur une zone exempte d’armes nucléaires en Afrique (Traité de Pelindaba)
Договор о зоне, свободной от ядерного оружия, в Африке (Пелиндабский договор)
Tratado sobre una Zona Libre de Armas Nucleares en África (Tratado de Pelindaba)
Vertrag von Pelindaba über die kernwaffenfreie Zone in Afrika (Vertrag von Pelindaba)
アフリカ非核兵器地帯条約（ペリンダバ条約）

1.7. Treaty on a Nuclear-Weapon-Free Zone in Central Asia (Semipalatinsk Treaty)

معاهدة إنشاء منطقة خالية من الأسلحة النووية في آسيا الوسطى (معاهدة سيميبالاتينسك)
中亚无核武器区条约（塞米巴拉金斯克条约）
Traité portant création d’une zone exempte d’armes nucléaires en Asie centrale (Traité de Semipalatinsk)
Договор о зоне, свободной от ядерного оружия, в Центральной Азии (Семипалатинский договор)
Tratado sobre una Zona Libre de Armas Nucleares en Asia Central (Tratado de Semipalatinsk)
Vertrag von Semipalatinsk über die kernwaffenfreie Zone in Zentralasien (Vertrag von Semipalatinsk)
中央アジア非核兵器地帯条約 （セミパラチンスク条約）

1.8. Agreement Between the Republic of Argentina and the Federative Republic of Brazil for the Exclusively Peaceful Use of Nuclear Energy

اتفاق بين جمهورية الأرجنتين وجمهورية البرازيل الاتحادية لحصر استخدام الطاقة النووية في الأغراض السلمية

阿根廷共和国和巴西联邦共和国关于核能仅用于和平利用的协定

Accord entre la République argentine et la République fédérative du Brésil pour l'utilisation exclusivement pacifique de l'énergie nucléaire

Соглашение между Аргентинской Республикой и Федеративной Республикой Бразилия об исключительно мирном использовании ядерной энергии

Acuerdo entre la República Argentina y la República Federativa del Brasil para el Uso Exclusivamente Pacífico de la Energía Nuclear

Übereinkommen zwischen der Republik Argentinien und der Föderativen Republik Brasilien über die ausschließlich friedliche Nutzung der Kernenergie

原子力の平和的利用に限ったアルゼンチン共和国とブラジル連邦共和国との間の協定

1.9. Treaty Establishing the European Atomic Energy Community (Euratom Treaty)

معاهدة إنشاء الجماعة الأوروبية للطاقة الذرية (معاهدة اليوراتوم)

欧洲原子能联营条约（欧原联条约）

Traité instituant la Communauté européenne de l'énergie atomique (Traité Euratom)

Договор об учреждении Европейского сообщества по атомной энергии (Договор о Евратоме)

Tratado Constitutivo de la Comunidad Europea de la Energía Atómica (Tratado Euratom)

Vertrag zur Gründung der Europäischen Atomgemeinschaft (Euratom-Vertrag)

欧州原子力共同体を設立する条約（ユーラトム条約）

1.10. Bilateral cooperation agreement

اتفاق تعاون ثنائي

双边合作协议

Accord bilatéral de coopération

Двустороннее соглашение о сотрудничестве

acuerdo bilateral de cooperación

Zweiseitige Kooperationsvereinbarung

二国間（原子力）協力協定

1.11. Project and supply agreement

اتفاق مشروع وتوريد

项目和供应协定

Accord de projet et de fourniture

Соглашение о проекте и поставках

acuerdo de proyecto y suministro

Vereinbarung über ein Projektvorhaben oder eine Lieferung

プロジェクト及び供給協定

1.12. The Application of Safeguards in Relation to the Granting of Technical Assistance

تطبيق الضمانات فيما يتعلق بمنح المساعدة التقنية

与提供技术援助有关的保障的实施

Application des garanties dans le cadre de l'assistance technique

Применение гарантий в связи с предоставлением технической помощи

Aplicación de Salvaguardias en relación con la Asistencia Técnica

Die Anwendung von Sicherungsmaßnahmen im Zusammenhang mit der Gewährung von technischer Hilfe

技術支援の供与に関する保障措置の適用

1.13. Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the IAEA

اتفاق تكميلي منقح بشأن تقديم المساعدة التقنية من جانب الوكالة الدولية للطاقة الذرية

经修订的国际原子能机构提供技术援助的补充协定

Accord complémentaire révisé concernant la fourniture d'une assistance technique par l'AIEA

Пересмотренное дополнительное соглашение о предоставлении МАГАТЭ технической помощи

Acuerdo Suplementario Revisado sobre la Prestación de Asistencia Técnica por el OIEA

Geänderte Zusatzvereinbarung über die technische Hilfeleistung durch die IAEO

IAEAによる技術支援の提供に関する改訂補足協定

1.14. The Agency's Inspectors (the Inspectors Document)

مفتشو الوكالة (وثيقة المفتشين)

国际原子能机构的视察员（视察员文件）
Les inspecteurs de l’Agence (Document des inspecteurs)
Инспектора Агентства (Документ об инспекторах)
Inspectores del Organismo (Documento relativo a los Inspectores)
Die Inspektoren der IAEO (das Inspektorendokument)
機関（IAEA）の査察員（査察員文書）

1.15. The Agency’s Safeguards

ضمانات الوكالة

国际原子能机构的保障
Les garanties de l’Agence
Гарантии Агентства
Salvaguardias del Organismo
Die IAEO-Sicherungsmaßnahmen
機関（IAEA）の保障措置

1.16. The Agency’s Safeguards System (1965, as Provisionally Extended in 1966 and 1968)

نظام ضمانات الوكالة (نظام 1965، بصيغته الموسعة مؤقتاً في عام 1966 وعام 1968)

国际原子能机构的保障体系（1965年、1966年和1968年临时扩充）
Le système de garanties de l’Agence (1965, provisoirement étendu en 1966 et 1968)
Система гарантий Агентства (1965 года, расширенная в предварительном порядке в 1966 и в 1968 годах)
Sistema de Salvaguardias del Organismo (1965, ampliado provisionalmente en 1966 y 1968)
Das System der IAEO-Sicherungsmaßnahmen (1965, vorläufig erweitert 1966 und 1968)
機関（IAEA）の保障措置システム（1965年策定、1966年及び1968年に暫定的に拡張）

1.17. The Structure and Content of Agreements Between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons

هيكل ومضمون الاتفاقات التي تعقد بين الوكالة والدول بموجب معاهدة عدم انتشار الأسلحة النووية

根据《不扩散核武器条约》的要求国际原子能机构与各国之间的协定的结构和内容

Structure et contenu des accords à conclure entre l'Agence et les États dans le cadre du Traité sur la non-prolifération des armes nucléaires

Структура и содержание соглашений между Агентством и государствами, требуемых в связи с Договором о нераспространении ядерного оружия

Estructura y Contenido de los Acuerdos entre los Estados y el Organismo Requeridos en relación con el Tratado sobre la No Proliferación de las Armas Nucleares

Struktur und Inhalt von Übereinkommen zwischen der IAEO und Staaten gemäß den Erfordernissen des Vertrags über die Nichtverbreitung von Kernwaffen

核兵器の不拡散に関する条約に関連して要求される機関（IAEA）と各国との間の協定の構成及び内容

1.18. Model Protocol Additional to the Agreement(s) Between State(s) and the International Atomic Energy Agency for the Application of Safeguards

نموذج بروتوكول إضافي للاتفاق المعقود (الاتفاقات المعقودة) بين الدولة (الدول) والوكالة الدولية للطاقة الذرية لتطبيق الضمانات

各国和国际原子能机构关于实施保障的协定的附加议定书范本

Modèle de protocole additionnel à l'accord (aux accords) entre un État (des États) et l'Agence internationale de l'énergie atomique relatif(s) à l'application de garanties

Типовой дополнительный протокол к Соглашению(ям) между государством(ами) и Международным агентством по атомной энергии о применении гарантий

Modelo de Protocolo Adicional al (a los) Acuerdo(s) entre el (los) Estado(s) y el Organismo Internacional de Energía Atómica para la Aplicación de Salvaguardias

Modell des Zusatzprotokolls zum Übereinkommen zwischen Staaten und der Internationalen Atomenergie-Organisation zur Anwendung von Sicherungsmaßnahmen

保障措置の適用のための各国及び国際原子力機関との間の協定に追加されるモデル議定書

1.19. Agreement on the Privileges and Immunities of the International Atomic Energy Agency

اتفاق امتيازات وحصانات الوكالة الدولية للطاقة الذرية

国际原子能机构特权和豁免协定
Accord sur les privilèges et immunités de l'Agence internationale de l'énergie atomique
Соглашение о привилегиях и иммунитетах Международного агентства по атомной энергии
Acuerdo sobre Privilegios e Inmunidades del Organismo Internacional de Energía Atómica
Vereinbarung über die Vorrechte und Befreiungen der Internationalen Atomenergie-Organisation
IAEAの特権及び免除に関する協定

1.20. Safeguards agreement

اتفاق ضمانات

保障协定
Accord de garanties
Соглашение о гарантиях
acuerdo de salvaguardias
Übereinkommen über Sicherungsmaßnahmen
保障措置協定

1.21. INFCIRC/153-type safeguards agreement

اتفاق ضمانات من النوع INFCIRC/153

INFCIRC/153型保障协定
Accord de garanties du type INFCIRC/153
Соглашение о гарантиях на основе документа INFCIRC/153
acuerdo de salvaguardias tipo INFCIRC/153
Sicherungsübereinkommen nach dem INFCIRC/153-Modell
INFCIRC/153型保障措置協定

1.22. Comprehensive safeguards agreement (CSA)

اتفاق ضمانات شاملة

全面保障协定
Accord de garanties généralisées (AGG)
Соглашение о всеобъемлющих гарантиях (СВГ)
acuerdo de salvaguardias amplias (ASA)
Übereinkommen über umfassende Sicherungsmaßnahmen
包括的保障措置協定（CSA）

1.23. Item-specific safeguards agreement

اتفاق ضمانات يخص مفردات بعينها

特定物项保障协定

Accord de garanties relatif à des éléments particuliers
Соглашение о гарантиях в отношении конкретных предметов
acuerdo de salvaguardias específico para partidas
Gegenstand-spezifisches Sicherungsübereinkommen
対象物特定保障措置協定

1.24. Voluntary offer agreement (VOA)

اتفاق ضمانات طوعي

自愿提交协定

Accord de soumission volontaire (ASV)
Соглашение о добровольной постановке под гарантии (СДП)
acuerdo de ofrecimiento voluntario (AOV)
Übereinkommen über die freiwillige Anwendung von Sicherungsmaßnahmen
自発的提供協定（ボランタリーオファー協定）（VOA）

1.25. Additional protocol (AP)

بروتوكول إضافي

附加议定书

Protocole additionnel (PA)
Дополнительный протокол (ДП)
protocolo adicional (PA)
Zusatzprotokoll (ZP)
追加議定書（AP）

1.26. Original small quantities protocol (original SQP)

بروتوكول كميات صغيرة أصلي

原始“小数量议定书”

Protocole relatif aux petites quantités de matières fondé sur le modèle initial (PPQM fondé sur le modèle initial)
Первоначальный протокол о малых количествах (первоначальный ПМК)
protocolo sobre pequeñas cantidades original (PPC original)
Ursprüngliches Protokoll betreffend geringe Mengen (ursprüngliches SQP)

初版少量議定書（初版SQP）

1.27. Revised small quantities protocol (revised SQP)

بروتوكول كميات صغيرة منقَّح

经修订的“小数量议定书”

Protocole relatif aux petites quantités de matières fondé sur le modèle révisé (PPQM fondé sur le modèle révisé)

Пересмотренный протокол о малых количествах (пересмотренный ПМК)

protocolo sobre pequeñas cantidades revisado (PPC revisado)

Überarbeitetes Protokoll betreffend geringe Mengen (überarbeitetes SQP)

改訂少量議定書（改訂SQP）

1.28. Suspension protocol

بروتوكول تعليق

暂停实施议定书

Protocole de suspension

Протокол о приостановлении

protocolo de suspensión

Protokoll über Bestimmungen zur Aufhebung eines Übereinkommens

停止議定書

1.29. Cooperation protocol

بروتوكول تعاون

合作议定书

Protocole de coopération

Протокол о сотрудничестве

protocolo de cooperación

Protokoll über die Zusammenarbeit

協力議定書

1.30. Subsidiary arrangements

ترتيبات فرعية

辅助安排

Arrangements subsidiaires

Дополнительные положения

arreglos subsidiarios
Ergänzende Vereinbarungen
補助取決め（補助取極）

1.31. Modified Code 3.1 of the General Part of the Subsidiary Arrangements to a safeguards agreement

البند المعدَّل 3-1 من الجزء العام من الترتيبات الفرعية الملحقة باتفاق الضمانات

保障协定“辅助安排”总则经修订的第3.1条

Rubrique 3.1 modifiée des arrangements subsidiaires à un accord de garanties

Измененный код 3.1 общей части дополнительных положений к соглашению о гарантиях

versión modificada de la sección 3.1 de la parte general de los arreglos subsidiarios de un acuerdo de salvaguardias

Modifizierter Code 3.1 des Allgemeinen Teils der Ergänzenden Vereinbarungen zu einem Sicherungsübereinkommen

保障措置協定補助取決め（取極）総論部修正コード3.1

1.32. Voluntary reporting scheme (VRS) on nuclear material and specified equipment and non-nuclear material

نظام تبليغ طوعي عن مواد نووية ومعدات محددة وعن مواد غير نووية

关于核材料和规定设备及非核材料的自愿报告机制（自愿报告机制）

Dispositif de déclaration volontaire des matières nucléaires et des équipements et matières non nucléaires spécifiés

Схема добровольной отчетности (СДО) о ядерном материале и согласованном оборудовании и неядерном материале

mecanismo de notificación voluntaria (MNV) de material nuclear y equipo especificado y material no nuclear

Freiwillige Berichterstattung zu speziellen Ausrüstungen und nichtnuklearen Materialien

核物質並びに特定の機器及び非核物質に関する自発的報告スキーム（体制）（VRS）

1.33. Notification of transfers of nuclear material to non-nuclear-weapon States

إخطار بعمليات نقل مواد نووية إلى دول غير حائزة لأسلحة نووية

向无核武器国家转让核材料的通知

Notification de transferts de matières nucléaires à des États non dotés d’armes nucléaires
Уведомление о передачах ядерного материала государствам, не обладающим ядерным оружием
notificación de traslados de material nuclear a Estados no poseedores de armas nucleares
Mitteilung über Lieferungen von Kernmaterial an Nicht-Kernwaffenstaaten
非核兵器国への核物質の移転に関する通告

1.34. Neptunium (Np) and americium (Am) monitoring scheme

نظام رصد النبتونيوم والأميريشيوم

镎和镅监测机制
Dispositif de surveillance du neptunium (Np) et de l’américium (Am)
Схема мониторинга нептуния (Np) и америция (Am)
plan de vigilancia del neptunio (Np) y el americio (Am)
Neptunium (Np) und Americium (Am) Überwachungsschema
ネプツニウム（Np）及びアメリシウム（Am）のモニタリングスキーム（体制）

1.35. Zangger Committee Export Guidelines

المبادئ التوجيهية للتصدير الصادرة عن لجنة تزانغر

桑戈委员会出口准则
Directives du Comité Zangger sur les exportations
Руководящие принципы Комитета Цангера по экспорту
Directrices del Comité Zangger sobre Exportaciones
Ausfuhrrichtlinien des Zangger-Komitees
ザンガー委員会輸出ガイドライン

1.36. Nuclear Suppliers Group Guidelines

المبادئ التوجيهية لمجموعة المُوَرِّدين النوويين

核供应国集团准则
Directives du Groupe des fournisseurs nucléaires
Руководящие принципы Группы ядерных поставщиков
Directrices del Grupo de Suministradores Nucleares
NSG-Richtlinien
原子力供給国グループガイドライン

1.37. Guidelines for the Management of Plutonium

المبادئ التوجيهية لإدارة البلوتونيوم

钚管理准则

Directives relatives à la gestion du plutonium

Руководящие принципы обращения с плутонием

Directrices para la Gestión del Plutonio

Richtlinien für die Handhabung von Plutonium

プルトニウム管理ガイドライン

2. IAEA SAFEGUARDS: PURPOSE, OBJECTIVES AND SCOPE

ضمانات الوكالة الدولية للطاقة الذرية: غرضها وغاياتها ونطاقها

国际原子能机构保障：目的、目标和范围

GARANTIES DE L'AIEA : OBJECTIFS ET CHAMP D'APPLICATION

ГАРАНТИИ МАГАТЭ: ПРЕДНАЗНАЧЕНИЕ, ЦЕЛИ И ОБЛАСТЬ ПРИМЕНЕНИЯ

SALVAGUARDIAS DEL OIEA: FINALIDAD, OBJETIVOS Y ALCANCE

IAEO-SICHERUNGSMAßNAHMEN: ZWECK, ZIELE UND ANWENDUNGSBEREICH

IAEA保障措置：目的、目標及び範囲

2.1. IAEA safeguards

ضمانات الوكالة

国际原子能机构保障

Garanties de l'AIEA

Гарантии МАГАТЭ

salvaguardias del OIEA

IAEO-Sicherungsmaßnahmen

IAEA保障措置

2.2. IAEA safeguards system

نظام ضمانات الوكالة

国际原子能机构保障体系

Système des garanties de l'AIEA

Система гарантий МАГАТЭ

sistema de salvaguardias del OIEA

System der IAEO-Sicherungsmaßnahmen

IAEA保障措置体系

2.3. Purpose of IAEA safeguards

الغرض من ضمانات الوكالة

国际原子能机构保障的目的

Objectif des garanties de l’AIEA

Предназначение гарантий МАГАТЭ

finalidad de las salvaguardias del OIEA

Zweck der IAEO-Sicherungsmaßnahmen

IAEA保障措置の目的

2.4. Scope of IAEA safeguards

نطاق ضمانات الوكالة

国际原子能机构保障的范围

Champ d’application des garanties de l’AIEA

Область применения гарантий МАГАТЭ

alcance de las salvaguardias del OIEA

Anwendungsbereich der IAEO-Sicherungsmaßnahmen

IAEA保障措置の範囲

2.5. Generic safeguards objectives

الأهداف العامة للضمانات

一般保障目标

Objectifs génériques des garanties

Общие цели гарантий

objetivos de salvaguardias genéricos

Allgemeine Ziele der Sicherungsmaßnahmen

一般的保障措置目標

2.6. Diversion of nuclear material

تحريف المواد النووية

核材料转用

Détournement de matières nucléaires

Переключение ядерного материала

desviación de material nuclear

Abzweigung von Kernmaterial

核物質の転用

2.7. Misuse

إساءة استخدام

滥用

Utilisation abusive
Использование не по назначению
uso indebido
Missbrauch
不正使用

2.8. Non-compliance

عدم امتثال

违约

Non-respect
Несоблюдение
incumplimiento
Vertragsverletzung
不履行

2.9. Undeclared nuclear material and activities

مواد وأنشطة نووية غير مُعلَنة

未申报核材料和核活动

Matières et activités nucléaires non déclarées
Незаявленный ядерный материал и деятельность
materiales y actividades nucleares no declarados
Nicht-deklariertes Kernmaterial und nicht-deklarierte Tätigkeiten
未申告の核物質及び原子力活動

2.10. Undeclared facility or location outside facilities (LOF)

مرفق غير مُعلَن أو موقع خارج المرافق غير مُعلَن

未申报设施或设施外场所

Installation ou emplacement hors installation (EHI) non déclaré(e)
Незаявленная установка или место нахождения вне установок (МВУ)
instalación o lugar situado fuera de las instalaciones (LFI) no declarados
Nicht-deklarierte Anlage oder nicht-deklarierter Bereich außerhalb von

Anlagen
未申告の施設または施設外の場所（LOF）

2.11. Deterrence

ردع

遏制
Dissuasion
Сдерживание
disuasión
Abschreckung
抑止

2.12. Starting point of IAEA safeguards under a CSA

نقطة بداية تطبيق ضمانات الوكالة بموجب اتفاق ضمانات شاملة

全面保障协定规定的国际原子能机构保障的起点
Point de départ de l’application des garanties de l’AIEA dans le cadre d’un AGG
Начальная точка применения гарантий МАГАТЭ на основании СВГ
punto inicial de las salvaguardias del OIEA con arreglo a un ASA
Startpunkt der IAEO-Sicherungsmaßnahmen gemäß eines CSA
CSAに基づくIAEA保障措置の開始点

2.13. Termination of IAEA safeguards

رفع ضمانات الوكالة

国际原子能机构保障的终止
Levée des garanties de l’AIEA
Прекращение гарантий МАГАТЭ
cese de las salvaguardias del OIEA
Beendigung der IAEO-Sicherungsmaßnahmen
IAEA保障措置の終了

2.14. Exemption from IAEA safeguards

إعفاء من ضمانات الوكالة

国际原子能机构保障的免除
Exemption des garanties de l’AIEA
Освобождение от гарантий МАГАТЭ
exención de la aplicación de las salvaguardias del OIEA

Befreiung von den IAEO-Sicherungsmaßnahmen
IAEA保障措置の免除

2.15. Non-application of IAEA safeguards to nuclear material to be used in non-peaceful activities

عدم تطبيق ضمانات الوكالة على المواد النووية التي يُزمع استخدامها في أنشطة غير سلمية

对用于非和平活动的核材料不实施国际原子能机构保障

Non-application des garanties de l'AIEA aux matières nucléaires devant être utilisées dans des activités non pacifiques

Неприменение гарантий МАГАТЭ к ядерному материалу, используемому в немирной деятельности

no aplicación de las salvaguardias del OIEA al material nuclear que vaya a utilizarse en actividades con fines no pacíficos

Nichtanwendung der IAEO-Sicherungsmaßnahmen bei Kernmaterial für nicht-friedliche Verwendung

非平和的な活動に用いられる核物質のIAEA保障措置の適用除外

2.16. Suspension of IAEA safeguards

تعليق ضمانات الوكالة

国际原子能机构保障的中止

Suspension des garanties de l'AIEA

Приостановление гарантий МАГАТЭ

suspensión de las salvaguardias del OIEA

Suspendierung (Aussetzung) der IAEO-Sicherungsmaßnahmen

IAEA保障措置の停止

2.17. Substitution

إحلال

替代

Substitution

Замещение

sustitución

Substituierung (Ersetzung)

代替

3. SAFEGUARDS CONCEPTS, APPROACHES AND MEASURES

مفاهيم ونُهُج وتدابير الضمانات

保障方案、概念和措施

MÉTHODES DE CONTRÔLE, CONCEPTS ET MESURES
КОНЦЕПЦИИ, ПОДХОДЫ К ПРИМЕНЕНИЮ И МЕРЫ ГАРАНТИЙ
CONCEPTOS, ENFOQUES Y MEDIDAS DE SALVAGUARDIAS
SICHERUNGSMAßNAHMEN: KONZEPTE, ANSÄTZE, EINZELMAßNAHMEN
保障措置概念、手法及び手段

3.1. State-level concept (SLC)

مفهوم الضمانات على مستوى الدولة (مفهوم مستوى الدولة)

国家一级概念

Concept d'application des garanties au niveau de l'État

Концепция применения гарантий на уровне государства, концепция на уровне государства (КУГ)

concepto a nivel de un Estado (CNE)

Konzept auf Staatsebene

国レベル概念（SLC）

3.2. State-level safeguards

تطبيق الضمانات على مستوى الدولة

国家一级保障

Application des garanties au niveau de l'État

Гарантии на уровне государства

salvaguardias a nivel de un Estado

Sicherungsmaßnahmen auf Staatsebene

国レベル保障措置

3.3. State-specific factors (SSFs)

عوامل خاصة بكل دولة

国别因素

Facteurs propres à l'État

Факторы, характеризующие государство (ФХГ)

factores específicos de un Estado (FEE)

Staatsspezifische Faktoren

国固有要素（SSFs）

3.4. Safeguards approach

نهج الضمانات

保障方案

Méthode de contrôle

Подход к применению гарантий

enfoque de salvaguardias

Ansatz für Sicherungsmaßnahmen

保障措置アプローチ

3.5. State-level safeguards approach (SLA)

نهج الضمانات على مستوى الدولة

国家一级保障方案

Méthode de contrôle au niveau de l’État (MNE)

Подход к применению гарантий на уровне государства (ПУГ)

enfoque de salvaguardias a nivel de un Estado (ENE)

Ansatz für Sicherungsmaßnahmen auf Staatsebene

国レベル保障措置アプローチ（SLA）

3.6. Broader conclusion

استنتاج أوسع نطاقاً

更广泛的结论

Conclusion élargie

Расширенное заключение

conclusión más amplia

Umfassendere Schlussfolgerung

拡大結論

3.7. Integrated safeguards

ضمانات متكاملة

一体化保障

Garanties intégrées

Интегрированные гарантии

salvaguardias integradas

Integriertes System von Sicherungsmaßnahmen

統合保障措置

3.8. Programme 93+2

البرنامج 93+2

93 + 2 计划
Programme 93+2
«Программа 93+2»
Programa 93+2
Programm 93+2
93+2計画

3.9. Model (generic) facility safeguards approaches

نُهُج ضمانات نموذجية (عامة) خاصة بنوع معيَّن من المرافق
标准（通用）设施保障方案
Méthodes types (génériques) de contrôle d’une installation
Типовые (общие) подходы к применению гарантий на установке
enfoques modelo (genéricos) de salvaguardias para instalaciones
(Allgemeines) Modell eines Ansatzes für Sicherungsmaßnahmen in einem Anlagentyp
モデル（一般的）施設に対する保障措置手法

3.10. Safeguards Criteria

معايير الضمانات

保障准则
Critères des garanties
Критерии гарантий
criterios de salvaguardias
Kriterien für Sicherungsmaßnahmen
保障措置クライテリア

3.11. Safeguards measures

تدابير الضمانات

保障措施
Mesures de contrôle
Меры гарантий
medidas de salvaguardias
Sicherungsmaßnahmen
保障措置手段

3.12. Safeguards activities

أنشطة الضمانات

保障活动

Activités de garanties

Деятельность по гарантиям

actividades de salvaguardias

Sicherungsaktivitäten

保障措置活動

3.13. Diversion path analysis

تحليل مسار التحريف

转用途径分析

Analyse des voies de détournement

Анализ путей переключения

análisis de las vías de desviación

Abzweigungspfad-Analyse

転用経路分析

3.14. Acquisition path analysis

تحليل مسار الاقتناء

获取途径分析

Analyse des voies d’acquisition

Анализ путей приобретения

análisis de las vías de adquisición

Beschaffungspfad-Analyse

取得経路分析

3.15. Acquisition path

مسار الاقتناء

获取途径

Voie d’acquisition

Путь приобретения

vía de adquisición

Beschaffungspfad

取得経路

3.16. Protracted diversion

تحريف مطوَّل

持续转用

Détournement progressif

Длительное переключение

desviación prolongada

Andauernde Abzweigung

少量分割転用

3.17. Abrupt diversion

تحريف مفاجئ

突然转用

Détournement soudain

Быстрое переключение

desviación súbita

Abrupte Abzweigung

一括転用

3.18. Concealment methods

أساليب إخفاء

弄虚作假的方法

Méthodes de dissimulation

Методы сокрытия

métodos de ocultación

Verschleierungsmethoden

隠ぺい手段

3.19. Significant quantity (SQ)

كمية معنوية

重要量

Quantité significative (QS)

Значимое количество (ЗК)

cantidad significativa (CS)

Signifikante Menge

有意量（SQ）

3.20. Conversion time

زمن التحويل

转化时间
Délai de conversion
Время конверсии
tiempo de conversión
Konversionszeit
転換時間

3.21. Detection time

زمن الكشف

探知时间
Délai de détection
Время обнаружения
tiempo de detección
Entdeckungszeit
探知（検知）時間

3.22. Technical objectives

أهداف تقنية

技术目标
Objectifs techniques
Технические цели
objetivos técnicos
Technische Ziele
技術的目標

3.23. Technical objective performance target

غاية أداء الأهداف التقنية

技术目标实绩指标
Valeur cible de l’objectif technique
Показатель достижения технической цели
meta fijada respecto del objetivo técnico
Leistungsvorgabe für Technisches Ziel
技術的目標の指標

3.24. Verification effort

جهد التحقق

核查工作量
Effort de vérification
Усилия по проверке
esfuerzo de verificación
Überprüfungsaufwand
検認業務量

3.25. Intensity of safeguards activity

كثافة نشاط الضمانات

保障活动强度
Intensité de l’activité de garanties
Интенсивность деятельности по гарантиям
intensidad de la actividad de salvaguardias
Intensität der Sicherungsmaßnahmen
保障措置活動の強度 n

3.26. Frequency of safeguards activity

وتيرة نشاط الضمانات

保障活动频率
Fréquence de l’activité de garanties
Частота деятельности по гарантиям
frecuencia de la actividad de salvaguardias
Häufigkeit der Sicherungsmaßnahmen
保障措置活動の頻度

3.27. IAEA inspection goal

هدف التفتيش طبقاً للوكالة

国际原子能机构视察指标
Objectif des inspections de l’AIEA
Цель инспекций МАГАТЭ
meta de inspección del OIEA
IAEO-Inspektionsziel
IAEA査察目標

3.28. Quantity component (of the IAEA inspection goal)

مكوِّن الكمية (في هدف التفتيش طبقاً للوكالة)

（国际原子能机构视察指标的）数量部分

Composante quantitative (de l'objectif des inspections de l'AIEA)
Количественный компонент (цели инспекций МАГАТЭ)
componente de cantidad (de la meta de inspección del OIEA)
Mengenkomponente (des IAEO-Inspektionsziels)
（IAEA査察目標の）量的要素

3.29. Timeliness component (of the IAEA inspection goal)

مكون التوقيت (في هدف التفتيش طبقاً للوكالة)

（国际原子能机构视察指标的）及时性部分

Composante temporelle (de l'objectif des inspections de l'AIEA)
Компонент своевременности (цели инспекций МАГАТЭ)
componente de oportunidad (de la meta de inspección del OIEA)
Rechtzeitigkeitskomponente (des IAEO-Inspektionsziels)
（IAEA査察目標の）適時性要素

3.30. Annual implementation plan (AIP)

خطة تنفيذ سنوية

年度执行计划

Plan annuel de mise en œuvre
Ежегодный план осуществления (ЕПО)
plan anual de aplicación (PAA)
Jährlicher Umsetzungsplan
年間実施計画（AIP）

3.31. Design information

معلومات تصميمية

设计资料

Renseignements descriptifs
Информация о конструкции
información sobre el diseño
Grundlegende technische Merkmale
設計情報

3.32. Design information questionnaire (DIQ)

استبيان معلومات تصميمية

设计资料调查表

Questionnaire concernant les renseignements descriptifs (QRD)

Вопросник по информации о конструкции (ВИК)

cuestionario de información sobre el diseño (DIQ)

Fragebogen zu den Grundlegenden technischen Merkmalen

設計情報質問書（DIQ）

3.33. Design information examination (DIE)

فحص معلومات تصميمية

设计资料审查

Examen des renseignements descriptifs

Изучение информации о конструкции (ИИК)

examen de la información sobre el diseño (DIE)

Prüfung der grundlegenden technischen Merkmale

設計情報検討（DIE）

3.34. Essential equipment list (EEL)

قائمة معدات أساسية

重要设备清单

Liste des équipements essentiels

Список ключевого оборудования (СКО)

lista de equipo esencial (LEE)

Liste der wesentlichen Ausrüstungen

必須機器リスト（EEL）

3.35. Flowsheet verification (FSV)

تحقُّق من سير العمليات

流程图核实

Vérification du déroulement des opérations (VDO)

Проверка технологической схемы (ПТС)

verificación del diagrama de flujo (VDF)

Flußdiagramm-Verifikation

フローシート検認（FSV）

3.36. Quality management system of the IAEA Department of Safeguards

نظام إدارة الجودة الخاص بإدارة الضمانات التابعة للوكالة

国际原子能机构保障部质量管理体系

Système de gestion de la qualité du Département des garanties de l’AIEA

Система менеджмента качества Департамента гарантий МАГАТЭ

sistema del Departamento de Salvaguardias del OIEA de gestión de la calidad

Qualitätsmanagementsystem der IAEO-Abteilung für Sicherungsmaßnahmen

IAEA保障措置局の品質管理体系

4. NUCLEAR MATERIAL, NON-NUCLEAR MATERIAL, NUCLEAR INSTALLATIONS AND NUCLEAR RELATED ACTIVITIES

المادة النووية، والمادة غير النووية، والمنشآت النووية، والأنشطة المتصلة بالمجال النووي

核材料、非核材料、核装置和核相关活动

MATIÈRES NUCLÉAIRES, MATIÈRES NON NUCLÉAIRES, INSTALLATIONS NUCLÉAIRES ET ACTIVITÉS LIÉES AU NUCLÉAIRE

ЯДЕРНЫЙ МАТЕРИАЛ, НЕЯДЕРНЫЙ МАТЕРИАЛ, ЯДЕРНЫЕ УСТАНОВКИ И ОТНОСЯЩАЯСЯ К ЯДЕРНОЙ ОБЛАСТИ ДЕЯТЕЛЬНОСТЬ

MATERIAL NUCLEAR, MATERIAL NO NUCLEAR, INSTALACIONES NUCLEARES Y ACTIVIDADES DEL ÁMBITO NUCLEAR

NUKLEARES MATERIAL, NICHT-NUKLEARES MATERIAL, KERNTECHNISCHE EINRICHTUNGEN UND NUKLEARBEZOGENE TÄTIGKEITEN

核物質、非核物質、原子力構築物及び原子力関連活動

4.1. Nuclear material

مادة نووية

核材料

Matières nucléaires

Ядерный материал

material nuclear

Kernmaterial (nukleares Material)

核物質

4.2. Nuclide

نويدة

核素

Nucléide

Нуклид

nucleido

Nuklid

核種

4.3. Isotope

نظير

同位素

Isotope

Изотоп

isótopo

Isotop

同位体

4.4. Source material

مادة مصدرية

源材料

Matière brute

Исходный материал

material básico

Ausgangsmaterial

原料物質

4.5. Special fissionable material

مادة انشطارية خاصة

特种可裂变材料

Produit fissile spécial

Специальный расщепляющийся материал

material fisionable especial

Besonderes spaltbares Material

特殊核分裂性物質

4.6. Fissionable material

مادة انشطارية

可裂变材料
Matière fissile
Расщепляющийся материал
material fisionable
Spaltbares Material
核分裂性物質

4.7. Fertile material

مادة خصبة

可转换材料
Matière fertile
Материал для воспроизводства
material fértil
Brutmaterial
親物質

4.8. Uranium

يورانيوم

铀
Uranium
Уран
uranio
Uran
ウラン

4.9. Natural uranium

يورانيوم طبيعي

天然铀
Uranium naturel
Природный уран
uranio natural
Natururan
天然ウラン

4.10. Depleted uranium

يورانيوم مستنفد

贫化铀

Uranium appauvri

Обедненный уран

uranio empobrecido

Abgereichertes Uran

劣化ウラン

4.11. Low enriched uranium (LEU)

يورانيوم ضعيف الإثراء

低浓铀

Uranium faiblement enrichi (UFE)

Низкообогащенный уран (НОУ)

uranio poco enriquecido (UPE)

Niedrig angereichertes Uran

低濃縮ウラン（LEU）

4.12. High enriched uranium (HEU)

يورانيوم شديد الإثراء

高浓铀

Uranium hautement enrichi (UHE)

Высокообогащенный уран (ВОУ)

uranio muy enriquecido (UME)

Hoch angereichertes Uran

高濃縮ウラン（HEU）

4.13. Uranium-233

يورانيوم-233

铀-233

Uranium 233

Уран-233

uranio 233

Uran-233

ウラン-233

4.14. Plutonium

بلوتونيوم

钚

Plutonium
Плутоний
plutonio
Plutonium
プルトニウム

4.15. Mixed oxide (MOX)

خليط الأكسيدين (موكس)

混合氧化物

Mélange d’oxydes (MOX)
Смешанное оксидное топливо (MOX)
óxidos mixtos (MOX)
Mischoxid
混合酸化物（MOX）

4.16. Thorium

ثوريوم

钍

Thorium
Торий
torio
Thorium
トリウム

4.17. Americium

أميريشيوم

镅

Américium
Америций
americio
Americium
アメリシウム

4.18. Neptunium

نبتونيوم

镎
Neptunium
Нептуний
neptunio
Neptunium
ネプツニウム

4.19. Enrichment

إثراء

浓缩度
Enrichissement
Обогащение
enriquecimiento
Anreicherung
濃縮度（濃縮）

4.20. Depletion

استنفاد

贫化
Appauvrissement
Обеднение
empobrecimiento
Abreicherung
減損（劣化）

4.21. Transmutation

تحويل

嬗变
Transmutation
Трансмутация
transmutación
Umwandlung
核変換

4.22. Reprocessing

إعادة معالجة

后处理

Retraitement
Переработка
reprocesamiento
Wiederaufarbeitung
再処理

4.23. Material type

نوع المادة

材料类型

Type de matières
Тип материала
tipo de material
Materialtyp
物質タイプ

4.24. Material category

فئة المادة

材料类别

Catégorie de matières
Категория материала
categoría de material
Material-Kategorie
物質区分

4.25. Direct use material

مادة صالحة للاستعمال المباشر

直接使用材料

Matière d'emploi direct
Материал прямого использования
material de uso directo
Unmittelbar verwendbares Material, Material zum direkten Gebrauch
直接利用物質

4.26. Indirect use material

مادة صالحة للاستعمال غير المباشر

非直接使用材料

Matière d’emploi indirect

Материал непрямого использования

material de uso indirecto

Mittelbar verwendbares Material

間接利用物質

4.27. Material form

شكل المادة

材料形态

Forme des matières

Форма материала

forma del material

Materialbeschreibung

物質形状

4.28. Improved nuclear material

مادة نووية محسَّنة

改进的核材料

Matière nucléaire améliorée

Улучшенный ядерный материал

material nuclear mejorado

Verbessertes Kernmaterial

改良された核物質

4.29. Effective kilogram (ekg)

كيلوغرام فعال (كغ فعال)

有效千克

Kilogramme effectif

Эффективный килограмм (эф. кг)

kilogramo efectivo (kge)

Effektives Kilogramm

実効キログラム（ekg）

4.30. Feed material

مادة تغذية

供料

Matière d’alimentation

Сырьевой материал

material de alimentación

Einspeisematerial

供給物質

4.31. Scrap

خردة

废料

Rebuts de fabrication

Скрап

residuos

Schrott

スクラップ

4.32. Waste

نفايات

废物

Déchets

Отходы

desechos

Abfall

廃棄物

4.33. Hold-up

مادة عالقة

滞留量

Matière retenue en cours de procédé

Остаточный материал

material retenido

In der Anlage (Apparatur) zurückbleibendes Kernmaterial

ホールドアップ（滞留物）

4.34. Fuel element (or fuel assembly, fuel bundle)

عنصر وقود (أو مجمَّعة وقود، أو حزمة وقود)

燃料元件（或燃料组件、燃料棒束）

Élément combustible

Тепловыделяющий элемент (или тепловыделяющая сборка, пучок твэлов)

elemento combustible (o conjunto combustible, haz de combustible)

Brennelement

燃料要素（または燃料集合体、燃料バンドル）

4.35. Fuel component

مكوِّن وقود

燃料部件

Composant du combustible

Компонент тепловыделяющего элемента

componente combustible

Brennelement-Komponente

燃料構成要素

4.36. Specified non-nuclear material

مادة غير نووية محدَّدة

规定的非核材料

Matière non nucléaire spécifiée

Согласованный неядерный материал

material no nuclear especificado

Spezifiziertes nicht-nukleares Material

特定非核物質

4.37. Nuclear grade graphite

غرافيت صالح للاستعمال النووي

核级石墨

Graphite de pureté nucléaire

Ядерно-чистый графит

grafito de pureza nuclear

Nuklear reiner Graphit

原子炉級黒鉛

4.38. Deuterium and heavy water

ديوتيريوم وماء ثقيل

氘和重水

Deutérium et eau lourde

Дейтерий и тяжелая вода

deuterio y agua pesada

Deuterium und Schwerwasser

重水素及び重水

4.39. Zircaloy

سبيكة زركونيوم

锆合金

Zircaloy

Циркалой

zircaloy

Zirkaloy

ジルカロイ（ジルコニウム合金）

4.40. Nuclear fuel cycle

دورة وقود نووي

核燃料循环

Cycle du combustible nucléaire

Ядерный топливный цикл

ciclo del combustible nuclear

Kernbrennstoffkreislauf

核燃料サイクル

4.41. Physical model of the nuclear fuel cycle

نموذج مادي لدورة الوقود النووي

核燃料循环的物理模型

Modèle physique d’un cycle du combustible nucléaire

Физическая модель ядерного топливного цикла

modelo físico del ciclo del combustible nuclear

Physikalisches Modell des Kernbrennstoffkreislaufes

核燃料サイクルフィジカルモデル

4.42. Nuclear fuel cycle related research and development activities

أنشطة البحث والتطوير ذات الصلة بدورة الوقود النووي

与核燃料循环有关的研究与发展活动

Activités de recherche-développement liées au cycle du combustible nucléaire

Относящиеся к ядерному топливному циклу научно-исследовательские и опытно-конструкторские работы

actividades de investigación y desarrollo relacionadas con el ciclo del combustible nuclear

Forschungs- und Entwicklungsarbeiten auf dem Gebiet des Kernbrennstoffkreislaufs

核燃料サイクル関連研究開発活動

4.43. Facility

مرفق

设施

Installation

Установка

instalación

Anlage

施設

4.44. Location outside facilities (LOF)

مكان واقع خارج المرافق

设施外场所

Emplacement hors installation (EHI)

Место нахождения вне установок (МВУ)

lugar situado fuera de las instalaciones (LFI)

Ort außerhalb von Anlagen

施設外の場所（LOF）

4.45. Item facility

مرفق يحتوي على مواد في شكل مفردات

件料设施

Installation contenant des matières dénombrables

Установка с материалом в виде предметов
instalación con material en unidades
Anlage zur Handhabung von Kernmaterial in umschlossener Form
アイテム施設

4.46. Bulk handling facility

مرفق يحتوي على مواد في حالة سائبة

散料操作设施

Installation contenant des matières en vrac
Установка с материалом в балк-форме
instalación de manipulación de materiales a granel
Anlage zur Handhabung von Kernmaterial in offener Form
バルク取扱施設

4.47. Facility life cycle

دورة عمر المرفق

设施生命周期

Cycle de vie d'une installation
Жизненный цикл установки
ciclo de vida de una instalación
Lebenslauf einer Anlage
施設ライフサイクル

4.48. Shut-down facility (or shut-down LOF)

مرفق متوقِّف (أو مكان متوقِّف واقع خارج المرافق)

停运设施（或停运的设施外场所）

Installation ou EHI mis à l'arrêt
Остановленная установка (или остановленное МВУ)
instalación en régimen de parada (o LFI en régimen de parada)
Abgeschaltete Anlage (oder abgeschaltete LOF)
操業停止施設（または操業を停止したLOF）

4.49. Closed-down facility (or closed-down LOF)

مرفق مغلق (أو مكان مغلق واقع خارج المرافق)

关闭设施（或关闭的设施外场所）

Installation ou EHI mis à l'arrêt avec retrait des matières nucléaires

Закрытая установка (или закрытое МБУ)
instalación cerrada (o LFI cerrado)
Außer Betrieb genommene Anlage (oder außer Betrieb genommener LOF)
閉鎖施設（または閉鎖されたLOF）

4.50. Decommissioned for safeguards purposes

إخراج من الخدمة لأغراض الضمانات

为保障目的退役

Déclassé aux fins des garanties
Выведено из эксплуатации с точки зрения гарантий
clausurado desde el punto de vista de las salvaguardias
Stillgelegt hinsichtlich Sicherungsmaßnahmen
保障措置上の廃止措置完了（保障措置の廃止）

4.51. Nuclear installations

منشآت نووية

核装置

Installations nucléaires
Ядерные установки
instalaciones nucleares
Kerntechnische Einrichtungen
原子力構築物

4.52. Categorization of facilities and LOFs

تصنيف المرافق والأماكن الواقعة خارج المرافق

设施和设施外场所类别

Catégorisation des installations et des EHI
Категоризация установок и МБУ
categorización de instalaciones y LFI
Kategorisierung von Anlagen und LOFs
施設及びLOFの区分

4.53. Power reactors

مفاعلات قوى

动力堆

Réacteurs de puissance

Энергетические реакторы
reactores de potencia
Leistungsreaktor
原子炉

4.54. Research reactors

مفاعلات بحوث

研究堆

Réacteurs de recherche
Исследовательские реакторы
reactores de investigación
Forschungsreaktor
試験研究用原子炉

4.55. Critical assemblies

مجمعات حرجة

临界装置

Assemblages critiques
Критические сборки
conjuntos críticos
Kritische Anordnung (Kritische Anlage)
臨界実験装置

4.56. Conversion plants

محطات تحويل

转化厂

Usines de conversion
Заводы по конверсии
plantas de conversión
Konversionsanlage
転換工場

4.57. Fuel fabrication plants

محطات صنع الوقود

燃料制造厂

Usines de fabrication de combustible

Заводы по изготовлению топлива
plantas de fabricación de combustible
Brennelementfabrik
燃料加工工場

4.58. Reprocessing plants

محطات إعادة المعالجة

后处理厂

Usines de retraitement
Перерабатывающие заводы
plantas de reprocesamiento
Wiederaufarbeitungsanlage
再処理工場

4.59. Enrichment (isotope separation) plants

محطات إثراء (فصل النظائر)

浓缩（同位素分离）厂

Usines d’enrichissement (ou usines de séparation isotopique)
Установки по обогащению (разделению изотопов)
plantas de enriquecimiento (de separación de isótopos)
Anreicherungsanlage (Isotopentrennanlage)
濃縮（同位体分離）工場

4.60. Separate storage facilities

مرافق خزن منفصل

独立贮存设施

Installations d’entreposage séparées
Отдельные хранилища
instalaciones de almacenamiento separadas
Getrennte Lagereinrichtungen
独立の貯蔵施設

5. NUCLEAR MATERIAL ACCOUNTANCY

ممارسة حصر المواد النووية

核材料衡算

CONTRÔLE COMPTABLE DES MATIÈRES NUCLÉAIRES
УЧЕТ ЯДЕРНОГО МАТЕРИАЛА

CONTABILIDAD DE MATERIAL NUCLEAR
KERNMATERIAL-BUCHFÜHRUNG
核物質の計量

5.1. Nuclear material accounting

حصر المواد النووية

核材料衡算活动

Comptabilité des matières nucléaires
Ведение учета ядерного материала
recuento de material nuclear
Bilanzieren von Kernmaterial
核物質の計量活動

5.2. Nuclear material accountancy

ممارسة حصر المواد النووية

核材料衡算

Contrôle comptable des matières nucléaires
Учет ядерного материала
contabilidad de material nuclear
Buchführung von Kernmaterial
核物質の計量

5.3. Inventory

رصيد

存量

Inventaire
Инвентарное количество
inventario
Bestand
在庫

5.4. Annual throughput

خرج سنوي

年通过量

Débit annuel
Годовая производительность
caudal anual
Jährlicher Durchsatz

年間処理量

5.5. Throughput

خرج

通过量

Débit

Производительность

caudal

Durchsatz

処理量

5.6. Near real time accountancy (NRTA)

ممارسة الحصر في توقيت مقارب للتوقيت الحقيقي

近实时衡算

Contrôle comptable en temps proche du temps réel

Учет в режиме времени, близком к реальному (УВБР)

contabilidad de materiales en tiempo casi real (NRTA)

Zeitnahe Kernmaterial-Buchführung

近実時間計量（ニアリアルタイム計量）（NRTA）

5.7. Material balance area (MBA)

منطقة حصر المواد

材料平衡区

Zone de bilan matières (ZBM)

Зона баланса материала (ЗБМ)

zona de balance de materiales (MBA)

Materialbilanzzone (MBZ)

物質収支区域（MBA）

5.8. Catch-all material balance area (CAM)

منطقة شاملة لحصر المواد

一揽子材料平衡区

Zone de bilan matières globale

Объединенная зона баланса материала (ОЗБМ)

zona de balance de materiales general (CAM)

Zusammenfassende Materialbilanzzone

キャッチオール物質収支区域（CAM）

5.9. Strategic point

نقطة استراتيجية

战略点

Point stratégique

Ключевое место

punto estratégico

Strategischer Punkt

枢要な箇所（枢要点）

5.10. Key measurement point (KMP)

نقطة قياس أساسية

关键测量点

Point de mesure principal (PMP)

Ключевая точка измерения (КТИ)

punto clave de medición (KMP)

Schlüsselmesspunkt

主要測定点（KMP）

5.11. Batch

دفعة

批

Lot

Партия

lote

Charge

バッチ

5.12. Batch data

بيانات الدفعة

批数据

Données concernant le lot

Данные партии

datos del lote

Chargendaten

バッチデータ

5.13. Source data

بيانات مصدرية

源数据
Données de base
Исходные данные
datos de origen
Primärdaten
ソースデータ

5.14. Identity data (or identification data)

بيانات الهوية

标识数据
Éléments d'identification (ou données d'identification)
Идентификационные данные
datos identificativos (o datos de identificación)
Daten zur Identifizierung
同定データ

5.15. Unified uranium

يورانيوم موحَّد

合计铀
Uranium unifié
Унифицированный уран
uranio unificado
Gesamt-Uran
統一ウラン

5.16. Material description code (MDC)

رمز وصف المادة

材料说明代码
Code de description de la matière
Код описания материала (КОМ)
código de descripción del material (MDC)
Code zur Materialbeschreibung
物質記述コード（MDC）

5.17. Inventory change

تغيُّر الرصيد

存量变化
Variation de stock

Изменение инвентарного количества
cambio en el inventario
Bestandsänderung
在庫変動

5.18. Import and export (inventory change codes: RF, SF)

استيراد وتصدير (رمزا تغيُّر الرصيد: RF, SF)

进出口（存量变化代码：RF、SF）

Importation et exportation (codes de variation de stock : RF, SF)
Импорт и экспорт (коды изменения инвентарного количества: RF, SF)
importación y exportación (códigos de cambio en el inventario: RF, SF)
Einfuhr und Ausfuhr (Bestandsänderungscode: RF, SF)
輸入及び輸出（在庫変動コード：RF、SF）

5.19. Domestic receipt (inventory change codes: RD, RN, RS)

تسلم محلي (رموز تغيُّر الرصيد: RD, RN, RS)

国内收货（存量变化代码：RD、RN、RS）

Arrivée en provenance de l’intérieur (codes de variation de stock : RD, RN, RS)
Внутригосударственное поступление (коды изменения инвентарного количества: RD, RN, RS)
entrada de procedencia nacional (códigos de cambio en el inventario: RD, RN, RS)
Zugang aus dem Inland (Bestandsänderungscode: RD, RN, RS)
国内受入（在庫変動コード：RD、RN、RS）

5.20. Nuclear production (inventory change code: NP)

إنتاج نووي (رمز تغيُّر الرصيد: NP)

核产生（存量变化代码：NP）

Production nucléaire (code de variation de stock : NP)
Ядерное производство (код изменения инвентарного количества: NP)
producción nuclear (código de cambio en el inventario: NP)
Erzeugung durch Kernumwandlung (Bestandsänderungscode: NP)
核的生成（在庫変動コード：NP）

5.21. Accidental gain (inventory change code: GA)

زيادة عارضة (رمز تغُّر الرصيد: GA)

意外收获（存量变化代码：GA）

Gain accidentel (code de variation de stock : GA)

Непредвиденное увеличение (код изменения инвентарного количества: GA)

ganancia accidental (código de cambio en el inventario: GA)

Zufälliger Zuwachs (Bestandsänderungscode: GA)

事故増加（物）（在庫変動コード：GA）

5.22. De-exemption (inventory change codes: DU, DQ)

رفع الإعفاء (رمزا تغيُّر الرصيد DU, DQ)

解除豁免（存量变化代码：DU、DQ）

Levée d’exemption (codes de variation de stock : DU, DQ)

Повторная постановка под гарантии (коды изменения инвентарного количества: DU, DQ)

exención anulada (códigos de cambio en el inventario: DU, DQ)

Aufhebung der Befreiung (Bestandsänderungscode: DU, DQ)

保障措置再適用（在庫変動コード：DU、DQ）

5.23. Retained waste (inventory change code: TW)

نفايات مستبقاة (رمز تغيُّر الرصيد: TW)

存留废物（存量变化代码：TW）

Déchets conservés (code de variation de stock : TW)

Сохраняемые отходы (код изменения инвентарного количества: TW)

desechos retenidos (código de cambio en el inventario: TW)

Zwischengelagerter Abfall (Bestandsänderungscode: TW)

保管廃棄（物）（在庫変動コード：TW）

5.24. Domestic shipment (inventory change code: SD, SN)

شحن محلي (رمزا تغيُّر الرصيد: SD, SN)

国内发货（存量变化代码：SD、SN）

Expédition à destination de l’intérieur (codes de variation de stock : SD, SN)

Внутригосударственное отправление (коды изменения инвентарного количества: SD, SN)

envío dentro del territorio nacional (código de cambio en el inventario: SD, SN)

Versand im Inland (Bestandsänderungscode: SD, SN)

国内払出（在庫変動コード：SD、SN）

5.25. Nuclear loss (inventory change code: LN)

فقدان نووي (رمز تغيُّر الرصيد: LN)

核损耗（存量变化代码：LN）

Perte de matières nucléaires par consommation (code de variation de stock : LN)

Ядерные потери (код изменения инвентарного количества: LN)

pérdida nuclear (código de cambio en el inventario: LN)

Verlust durch Kernumwandlung (Bestandsänderungscode: LN)

核的損耗（在庫変動コード：LN）

5.26. Measured discard (inventory change code: LD)

مُهملات مُقاسة (رمز تغيُّر الرصيد: LD)

经测量的废弃物（存量变化代码：LD）

Rebuts mesurés (code de variation de stock : LD)

Измеренные безвозвратные потери (код изменения инвентарного количества: LD)

material descartado medido (código de cambio en el inventario: LD)

Gemessener Abfall (Bestandsänderungscode: LD)

測定済廃棄（物）（在庫変動コード：LD）

5.27. Exemption (of nuclear material) (inventory change codes: EU, EQ)

إعفاء (مادة نووية) (رمزا تغيُّر الرصيد: EU, EQ)

（核材料）免除保障（存量变化代码：EU、EQ）

Exemption (de matières nucléaires) (codes de variation de stock : EU, EQ)

Освобождение (ядерного материала) (коды изменения инвентарного количества: EU, EQ)

exención (de material nuclear) (códigos de cambio en el inventario: EU, EQ)

Befreiung (von Kernmaterial) (Bestandsänderungscode: EU,EQ)

（核物質の）免除（在庫変動コード：EU、EQ）

5.28. Termination of IAEA safeguards (inventory change code: TU)

رفع ضمانات الوكالة (رمز تغيُّر الرصيد: TU)

终止国际原子能机构保障（存量变化代码：TU）

Levée des garanties de l’AIEA (code de variation de stock : TU)

Прекращение гарантий МАГАТЭ (код изменения инвентарного количества: TU)

cese de las salvaguardias del OIEA (código de cambio en el inventario: TU)

Beendigung der IAEO-Sicherungsmaßnahmen (Bestandsänderungscode: TU)

IAEA保障措置の終了（在庫変動コード：TU）

5.29. Other loss (inventory change code: LA)

فقدان آخر (رمز تغيُّر الرصيد: LA)

其他损失（存量变化代码：LA）

Autre perte (code de variation de stock : LA)

Другие потери (код изменения инвентарного количества: LA)

otras pérdidas (código de cambio en el inventario: LA)

Andere Verluste (Bestandsänderungscode: LA)

その他の損失（在庫変動コード：LA）

5.30. Rebatching (inventory change codes: RM, RP)

إعادة تجميع الدفعات (رمزا تغيُّر الرصيد: RM, RP)

重新批处理（存量变化代码：RM、RP）

Réarrangement des lots (codes de variations de stock : RM, RP)

Изменение партии (коды изменения инвентарного количества: RM, RP)

recomposición del lote (códigos de cambio en el inventario: RM, RP)

Chargenverfolgung (Bestandsänderungscode: RM, RP)

リバッチング（在庫変動コード：RM, RP）

5.31. Adjustment

تسوية

调整

Ajustement

Уточнение

ajuste

Angleichung, Rundung

調整事項

5.32. Correction

تصويب

校正

Correction

Исправление

corrección

Berichtigung

訂正事項

5.33. Accounting records

سجلات الحصر

衡算记录

Relevés comptables

Учетная документация

registros contables

Buchungsbelege

計量記録

5.34. Operating records

سجلات التشغيل

运行记录

Relevés d'opérations

Эксплуатационная документация

registros operacionales

Betriebsprotokolle

操作記録（操業記録）

5.35. Supporting document

وثيقة داعمة

辅助性文件

Pièce justificative

Подтверждающий документ

documento de apoyo

Ergänzende Unterlage

証拠記録

5.36. Measurement system

نظام قياس

测量系统

Système de mesure

Система измерений

sistema de mediciones

Meßsystem

測定の体系

5.37. Metrological traceability

تتبع القياسات

计量可追溯性
Traçabilité métrologique
Метрологическая сопоставимость
trazabilidad metrológica
Meßtechnische Rückverfolgbarkeit
度量衡トレーサビリティ（計量学的追求性）

5.38. International standards of accountancy (ISA)

معايير الحصر الدولية

国际衡算标准
Normes internationales de contrôle comptable
Международные стандарты учета (МСУ)
parámetros internacionales de contabilidad (ISA)
Internationale Standards der Materialbilanzierung (ISA)
計量に関する国際基準（ISA）

5.39. International target values (ITVs)

قيم مستهدفة دولية

国际目标值
Valeurs cibles internationales (VCI)
Международные целевые значения погрешностей (МЗП)
valores internacionales objetivo (ITV)
Internationale Richtwerte
国際目標値（ITVs）

5.40. Stratum/strata

شريحة/شرائح

层
Strate/strates
Страта
estrato
Stratum/Strata
ストラータ

5.41. Rounding adjustment

تسوية بالتقريب

舍入调整

Ajustement pour les arrondis
Поправка на округление
ajuste por redondeo
Rundungsanpassung
端数調整

5.42. Source documents

وثائق مصدرية

源文件

Documents sources
Исходные документы
documentos fuente
Originaldokumente
ソースドキュメント

5.43. Book inventory (BI)

رصيد دفتري

账面存量

Stock comptable
Зарегистрированное инвентарное количество (ЗИК)
inventario contable (IC)
Buchbestand (über einen Materialbilanz-Zeitraum)
帳簿在庫（BI）

5.44. Physical inventory

رصيد مادي

实物存量

Stock physique
Фактически наличное количество
inventario físico
Realer Bestand
実在庫

5.45. Material balance component

مكون حصر المواد

材料平衡分项

Composante du bilan matières
Компонент баланса материала

componente del balance de materiales
Komponente der Materialbilanz
物質収支の構成要素

5.46. Material unaccounted for (MUF)

مادة غير محصورة

不明材料量

Différence d'inventaire (DI)
Неучтенное количество материала (НКМ)
material no contabilizado (MNC)
Nicht nachgewiesenes Material
在庫差（MUF）

5.47. Cumulative material unaccounted for (CuMUF)

محصلة المواد غير المحصورة

累积不明材料量

Différence d'inventaire cumulée (DI cumulée, DIC)
Совокупное неучтенное количество материала (СНКМ)
material no contabilizado acumulado (MNCa)
Aufsummiertes nicht nachgewiesenes Material
累積在庫差（累積MUF、CuMUF）

5.48. Shipper/receiver difference (SRD) (inventory change code: DI)

الفرق بين قياس الشاحن وقياس المستلم (رمز تغيُّر الرصيد: DI)

发货方/收货方差额（存量变化代码：DI）

Écart expéditeur/destinataire (EED) (indicatif de variation de stock : DI)
Расхождение в данных отправителя/получателя (РОП) (код изменения инвентарного количества: DI)
diferencia remitente/destinatario (DRD) (código de cambio en el inventario: DI)
Absender/Empfänger-Differenz
受払間差異（SRD）（在庫変動コード：DI）

5.49. Cumulative shipper/receiver difference

محصلة الفرق بين قياس الشاحن وقياس المستلم

累积发货方/收货方差额

Écart expéditeur/destinataire cumulé
Совокупное расхождение в данных отправителя/получателя

diferencia remitente/destinatario acumulada
Aufsummierte Absender/Empfänger-Differenzen
累積受払間差異（累積SRD）

5.50. Material balance period (MBP)

الفترة الفاصلة بين حصر المواد

材料平衡周期
Intervalle entre bilans matières (IBM)
Период баланса материала (ПБМ)
período de balance de materiales (MBP)
Materialbilanz-Zeitraum
物質収支期間（MBP）

5.51. Examination of records

فحص السجلات

记录的检查
Examen des relevés
Изучение документации
examen de los registros
Überprüfung der Buchungsunterlagen
記録の検査

5.52. Updating of the book inventory

استيفاء الرصيد الدفتري

账面存量的更新
Mise à jour du stock comptable
Обновление зарегистрированного инвентарного количества
actualización del inventario contable
Aktualisierung des Buchbestandes
帳簿在庫の更新

5.53. Inventory change verification

تحقُّق من تغيُّر الرصيد

存量变化核实
Vérification des variations de stock
Проверка изменения инвентарного количества
verificación de los cambios en el inventario
Nachprüfung der Bestandsänderungen

在庫変動の検認

5.54. Inventory verification

تحقق من الرصيد

存量核实

Vérification du stock

Проверка инвентарного количества

verificación del inventario

Nachprüfung des (Kernmaterial-) Bestandes

在庫検認

5.55. List of inventory items (LII) (or itemized inventory listing (IIL))

قائمة مفردات الرصيد (أو قائمة الرصيد المفصَّلة)

库存物项清单（或件料存量清单）

Liste des articles inventoriés

Список учетных единиц инвентарного количества (СУЕ) (или детализированный инвентарный список (ДИС))

lista de partidas del inventario (LII) (o lista pormenorizada del inventario (IIL))

Liste der Bestandsposten (LII) (oder Einzelaufstellung des Bestands (IIL))

在庫明細表（LII）（LIIまたはIIL）

5.56. Physical inventory verification (PIV)

تحقُّق من الرصيد المادي

实物存量核实

Vérification du stock physique (VSP)

Проверка фактически наличного количества (ПФК)

verificación del inventario físico (VIF)

Verifikation des realen Bestandes

実在庫検認（PIV）

5.57. Physical inventory verification equivalent

مكافئ التحقُّق من الرصيد المادي

实物存量核实等效

Équivalent de vérification du stock physique

Эквивалент проверки фактически наличного количества

equivalente de verificación del inventario físico

Äquivalent zur Verifikation des realen Bestands

等価実在庫検認

5.58. Interim inventory verification (IIV)

تحقُّق مؤقَّت من الرصيد

存量的中期核实

Vérification intermédiaire du stock

Промежуточная проверка инвентарного количества (ППИ)

verificación provisional del inventario (VPI)

Zwischenzeitliche Verifikation des (Kermaterial-) Bestandes

中間在庫検認（IIV）

5.59. Verification of nuclear material flows within an MBA

تحقُّق من تدفقات المواد النووية داخل منطقة حصر المواد

材料平衡区内核材料流量的核实

Vérification des flux de matières nucléaires dans une ZBM

Проверка движения ядерного материала в пределах ЗБМ

verificación de los flujos de material nuclear en una MBA

Verifikation des Kernmaterial-Flusses innerhalb einer Materialbilanzzone (MBZ)

MBA内の核物質の流れの検認

5.60. Verification of the operator's measurement system

تحقُّق من نظام القياس الذي تستخدمه الجهة المشغلة

营运者测量系统的核实

Vérification du système de mesure de l'exploitant

Проверка системы измерений оператора

verificación del sistema de mediciones del operador

Verifikation des betriebseigenen Meßsystems

事業者の測定体系の検認

5.61. IAEA accountancy verification methods

أساليب الوكالة للتحقُّق من ممارسات الحصر

国际原子能机构的衡算核实方法

Méthodes de contrôle comptable de l'AIEA

Методы МАГАТЭ по проверке ведения учета

métodos de verificación contable del OIEA

IAEO-Methoden zur Verifikation der (Kernmaterial-) Buchführung

IAEAの計量検認手法

5.62. Code 10

الرمز 10

第 10 条
Rubrique 10
Код 10
sección 10
Code 10
コード10

5.63. General ledger

دفتر الاستاذ للحسابات

总分类账
Grand livre
Общая книга учета
libro mayor general
Hauptbuch
台帳

5.64. Nuclear material control

مراقبة المواد النووية

核材料控制
Contrôle des matières nucléaires
Контроль ядерного материала
control de material nuclear
Kontrolle von Kernmaterial
核物質管理

5.65. Element code

رمز العنصر

元素代码
Code matière
Код элемента
código del elemento
Element-Code
元素コード

5.66. Category change procedure

إجراء تغيُّر الفئة

类别变更程序
Procédure de changement de catégorie
Процедура изменения категории
procedimiento de cambio de categoría
Verfahren zur Änderung der Kategorie
区分変更手順

5.67. Measurement basis

أساس القياس

测量基础
Base des mesures
Основа измерений
base de medición
Bedingung der Messung
測定ベース

5.68. Transit matching

مطابقة حالات العبور

转运匹配
Mise en correspondance des expéditions et des arrivées
Согласованность данных о передачах
comprobación de la correspondencia de traslados
Transitabgleich
移転照合

6. NUCLEAR MATERIAL MEASUREMENT TECHNIQUES AND EQUIPMENT

تقنيات ومعدات قياس المواد النووية

核材料测量技术和设备
TECHNIQUES ET MATÉRIEL DE MESURE DES MATIÈRES NUCLÉAIRES
МЕТОДЫ ИЗМЕРЕНИЯ ЯДЕРНОГО МАТЕРИАЛА И ИЗМЕРИТЕЛЬНОЕ ОБОРУДОВАНИЕ
TÉCNICAS Y EQUIPO DE MEDICIÓN DE MATERIAL NUCLEAR
METHODEN UND AUSRÜSTUNG ZUR MESSUNG VON KERNMATERIAL
核物質測定技術及び機器

6.1. Calibration

معايرة

校准

Étalonnage
Калибровка
calibración
Eichung
校正

6.2. Reference material

مادة مرجعية

参考物质

Matière de référence
Эталонный материал
material de referencia
Referenzmaterial
標準物質（基準物質）

6.3. Bulk measurement

قياس المواد السائبة

总体测量
Mesure de la masse
Балк-измерение
medición de masa
Massenmessung
バルク測定

6.4. Matrix

مصفوفة

基体
Matrice
Матрица
matriz
Matrix
マトリックス

6.5. Material sample

عينة المادة

材料样品

Échantillon de matière
Проба (образец) материала
muestra de material
Material Probe
物質試料

6.6. Representative sample

عيّنة ممثِّلة

代表性样品
Échantillon représentatif
Представительная проба
muestra representativa
Repräsentative Probe
代表試料

6.7. Calorimetry

قياس الحرارة

量热法
Calorimétrie
Калориметрия
calorimetría
Kalorimetrie
熱量分析法（カロリメトリー）

6.8. Assay

قياس

分析
Analyse/Dosage
Анализ
análisis
Messung
分析

6.9. Destructive analysis (DA)

تحليل متلف

破坏性分析
Analyse destructive (AD)
Разрушающий анализ (РА)

análisis destructivo (AD)
Zerstörende Analyse
破壊分析（DA）

6.10. Chemical titration

معايرة كيميائية

化学滴定法
Titrimétrie
Химическое титрование
titulación química
Chemische Titration
化学滴定

6.11. Controlled potential coulometry

قياس كولوني بالتحكم في القدرة الكهربائية

控制电位库仑法
Coulométrie à potentiel contrôlé
Кулонометрия с контролируемым потенциалом
culombimetría a potencial controlado
Potentialkontrollierte Coulometrie
定電位クーロメトリー

6.12. Gravimetric analysis

تحليل ثقالي

重量分析
Analyse gravimétrique
Гравиметрический анализ
análisis gravimétrico
Gravimetrische Analyse
重量分析

6.13. Isotope dilution mass spectrometry (IDMS)

قياس الطيف الكتلي بطريقة التخفيف النظيري

同位素稀释质谱测定法
Spectrométrie de masse à dilution isotopique
Масс-спектрометрия с изотопным разбавлением (МС-ИР)
espectrometría de masas por dilución isotópica (IDMS)
Isotopenverdünnungs-Massenspektrometrie

同位体希釈質量分析法（IDMS）

6.14. K-edge densitometry

قياس الكثافة بطريقة الحدّ-ك

K 边界密度计

Densitométrie de discontinuité K

Денситометрия с использованием эффекта K-полосы поглощения

densitometría de discontinuidad K

K-Kanten Densitometrie

K吸収端濃度計（K-エッジデンシトメトリー）

6.15. Mass spectrometry

قياس الطيف الكتلي

质谱测定法

Spectrométrie de masse

Масс-спектрометрия

espectrometría de masas

Massenspektrometrie

質量分析法

6.16. Gas source mass spectrometry (GSMS)

قياس الطيف الكتلي الغازي المصدر

气源质谱测定法

Spectrométrie de masse en phase gazeuse

Газовая масс-спектрометрия (ГМС)

espectrometría de masas de fuente gaseosa (GSMS)

Gasmassenspektrometrie

ガス源質量分析法（ガスマススペクトロメトリー）（GSMS
）

6.17. Thermal ionization mass spectrometry (TIMS)

قياس الطيف الكتلي بالتأيُّن الحراري

热电离质谱测定法

Spectrométrie de masse à thermo-ionisation (TIMS)

Термоионизационная масс-спектрометрия (ТИМС)

espectrometría de masas de ionización térmica (TIMS)

Thermoionisations-Massenspektrometrie

表面電離型質量分析法（TIMS）

6.18. Alpha spectrometry

قياس طيف أشعة ألفا

α 能谱测定法
Spectrométrie alpha
Альфа-спектрометрия
espectrometría alfa
Alpha-Spektrometrie
アルファ線スペクトロメトリー

6.19. Non-destructive assay (NDA)

قياس غير متلف

非破坏性分析
Analyse non destructive (AND)
Неразрушающий анализ (НРА)
análisis no destructivo (AND)
Zerstörungsfreie Analyse
非破壊分析（NDA）

6.20. Gamma ray spectrometry

قياس طيف أشعة غاما

γ 射线能谱测定法
Spectrométrie gamma
Гамма-спектрометрия
espectrometría gamma
Gammastrahlen-Spektrometrie
ガンマ線スペクトロメトリー

6.21. Gamma ray scanning

مسح بأشعة غاما

γ 射线扫描
Balayage gamma
Гамма-сканирование
gammagrafía
Gammastrahlen-Scanning
ガンマ線走査

6.22. Scintillation detector

كاشف وميضي

闪烁探测器
Détecteur à scintillation
Сцинтилляционный детектор
detector de centelleo
Szintillationszähler
シンチレーション検出器

6.23. Semiconductor detector

كاشف بشبه موصِّلات

半导体探测器
Détecteur à semi-conducteur
Полупроводниковый детектор
detector semiconductor
Halbleiterdetektor
半導体検出器

6.24. Neutron counting

عدّ النيوترونات

中子计数
Comptage neutronique
Счет нейтронов
recuento de neutrones
Neutronenzählung (Neutronenmessung)
中性子計数

6.25. Neutron coincidence counting

عدّ توافُق النيوترونات

中子符合计数
Comptage neutronique par coïncidence
Счет нейтронных совпадений
recuento de coincidencias neutrónicas
Neutronenkoinzidenzzählung
中性子同時計数

6.26. Neutron multiplicity counting

عدّ تضاعف النيوترونات

中子多重性计数
Comptage de multiplicité neutronique
Счет множественности нейтронов
recuento de la multiplicidad neutrónica
Neutronenmultiplizitätszähler
中性子多重度計数

6.27. Cerenkov radiation detection

كشف إشعاعات تشيرينكوف
切伦科夫辐射探测法
Détection du rayonnement de Tcherenkov
Регистрация черенковского излучения
detección de radiación Cherenkov
Nachweis (Messung) von Cerenkov-Strahlung
チェレンコフ放射光検出

6.28. Safeguards Analytical Laboratory (SAL)

مختبر التحليل الخاص بالضمانات
保障分析实验室
Laboratoire d'analyse pour les garanties (LAG)
Аналитическая лаборатория по гарантиям (АЛГ)
Laboratorio Analítico de Salvaguardias (LAS)
Analytisches Laboratorium der IAEO-Abteilung für Sicherungsmaßnahmen
保障措置分析所（SAL）

6.29. Network of Analytical Laboratories (NWAL)

شبكة مختبرات التحليل
分析实验室网络
Réseau de laboratoires d'analyse (NWAL)
Сеть аналитических лабораторий (САЛ)
Red de Laboratorios Analíticos (RLA)
Netzwerk von analytischen Laboratorien
ネットワークラボラトリー（NWAL）

6.30. Gamma ray counting

عدّ أشعة غاما
γ 射线计数

Comptage des rayons gamma
Счет гамма-излучения
recuento de rayos gamma
Gammastrahlen-Zählung
ガンマ線計数

6.31. Ion chamber

غرفة أيونية

电离室

Chambre d'ionisation
Ионизационная камера
cámara de iones
Ionenkammer
電離箱

6.32. Passive neutron coincidence counter

عدَّاد توافق نيوتروني خامل

无源中子符合计数器

Compteur de coïncidences neutroniques en mode passif
Пассивный счетчик нейтронных совпадений
contador pasivo de coincidencias neutrónicas
Passiver Neutronenkoinzidenzzähler
パッシブ中性子同時計数装置

6.33. Active neutron coincidence counter

عدَّاد توافق نيوتروني نشط

有源中子符合计数器

Compteur de coïncidences neutroniques en mode actif
Активный счетчик нейтронных совпадений
contador activo de coincidencias neutrónicas
Aktiver Neutronenkoinzidenzzähler
アクティブ中性子同時計数装置

6.34. X ray fluorescence (XRF)

تألُّق الأشعة السينية

X 射线荧光
Fluorescence X
Рентгеновская флуоресценция (РФ)

fluorescencia de rayos X (XRF)
Röntgenfluoreszenz
蛍光X線分析法（XRF）

6.35. Inductively coupled plasma mass spectrometry (ICP-MS)

قياس الطيف الكتلي البلازمي المقرون بالحث

电感耦合等离子体质谱测定法

Spectrométrie de masse à source plasma à couplage inductif (ICP-MS)

Масс-спектрометрия с индуктивно связанной плазмой (МС-ИСП)

espectrometría de masas con plasma acoplado por inducción (ICP-MS)

Induktiv gekoppelte Plasmamassenspektrometrie

誘導結合プラズマ質量分析法（ICP-MS）

6.36. Combined procedure for uranium concentration and enrichment assay (COMPUCEA)

إجراء مشترك لقياس تركيز اليورانيوم وإثرائه

铀浓度和富集度分析组合程序

Procédure combinée d’analyse de la concentration et de l’enrichissement en uranium (COMPUCEA)

Комбинированная процедура анализа концентрации и степени обогащения урана (COMPUCEA)

procedimiento combinado de análisis de la concentración y el enriquecimiento del uranio (COMPUCEA)

Kombiniertes Verfahren zur Bestimmung der Urankonzentration und -anreicherung

ウラン含有率及び濃縮度分析の統合手法（COMPUCEA）

6.37. Pu(VI) spectrophotometry (PUSP)

قياس الطيف الضوئي لتركز البلوتونيوم (سداسي التكافؤ)

钚（VI）分光光度测定法

Spectrophotométrie du Pu (VI)

Спектрофотомерия Pu(VI) (PUSP)

espectrofotometría Pu(VI) (PUSP)

Pu(VI)-Spektrophotometrie

Pu(VI)分光光度法（Pu(VI)吸光光度法）（PUSP）

6.38. Equipment Radiation Monitoring Laboratory (ERML)

مختبر الرصد الإشعاعي للمعدات

设备辐射监测实验室

Laboratoire de contrôle radiologique du matériel (ERML)
Лаборатория радиационного контроля оборудования (ЛРКО)
Laboratorio de Vigilancia Radiológica del Equipo (ERML)
Ausrüstung für das Strahlungsüberwachungslabor
機器放射線モニタリング分析所（ERML）

6.39. Sample transport

نقل العينات

样品运输
Transport des échantillons
Перевозка проб
transporte de muestras
Probentransport
試料輸送

6.40. Laser induced breakdown spectroscopy (LIBS)

قياس طيف التحلل المستحث بالليزر

激光诱导击穿光谱法
Spectroscopie de plasma induit par laser (LIBS)
Лазерно-искровая эмиссионная спектроскопия (ЛИЭС)
espectrometría de ruptura inducida por láser (LIBS)
Laser-induzierte Plasmaspektroskopie (LIPS)
レーザー誘起ブレークダウン分光法（LIBS）

7. CONTAINMENT AND SURVEILLANCE

الاحتواء والمراقبة

封隔和监视
CONFINEMENT ET SURVEILLANCE
СОХРАНЕНИЕ И НАБЛЮДЕНИЕ
CONTENCIÓN Y VIGILANCIA
RÄUMLICHE UMSCHLIEßUNG UND BEOBACHTUNG
封じ込め及び監視

7.1. Containment

احتواء

封隔
Confinement

Сохранение
contención
Räumliche Umschließung
封じ込め

7.2. Surveillance

مراقبة

监视
Surveillance
Наблюдение
vigilancia
Beobachtung
監視

7.3. Containment/surveillance device

جهاز احتواء/مراقبة

封隔/监视装置
Dispositif de confinement/surveillance
Устройство сохранения/наблюдения
dispositivo de contención/vigilancia
Gerät zur räumlichen Umschließung/Beobachtung
封じ込め／監視装置

7.4. Seal

ختم

封记
Scellé
Пломба
precinto
Siegel
封印

7.5. Containment/surveillance measures

تدابير الاحتواء/المراقبة

封隔/监视措施
Mesures de confinement/surveillance
Меры сохранения/наблюдения
medidas de contención/vigilancia

Maßnahmen zur räumlichen Umschließung/Beobachtung
封じ込め／監視手段

7.6. System of containment/surveillance measures

نظام تدابير الاحتواء/المراقبة

封隔/监视措施系统

Système de mesures de confinement/surveillance (système C/S)
Система мер сохранения/наблюдения
sistema de medidas de contención/vigilancia
System von räumlichen Umschließungs-/Beobachtungsmaßnahmen
封じ込め／監視体系

7.7. Vulnerability assessment

تقييم جوانب الضعف

薄弱性评定

Évaluation de la vulnérabilité
Оценка уязвимости
evaluación de la vulnerabilidad
Schwachstellen-Analyse
脆弱性評価

7.8. Joint use arrangement (JUA)

ترتيب الاستخدام المشترك

共用安排

Arrangement relatif à l'utilisation conjointe
Договоренность о совместном использовании (ДСИ)
disposiciones para la utilización conjunta (JUA)
Vereinbarung zur gemeinsamen Nutzung
共同利用取決め（JUA）

7.9. Joint use equipment (JUE)

معدات الاستخدام المشترك

共用设备

Matériel utilisé conjointement
Оборудование совместного использования (ОСИ)
equipo de utilización conjunta (JUE)
Gemeinsam genutzte Ausrüstung

共同利用機器（JUE）

7.10. Tamper indication

مؤشر تلاعب

干扰指示

Indication de manipulation frauduleuse

Признак вмешательства

indicación de manipulación ilícita

Verfälschungsanzeige

改ざんの徴候

7.11. Surveillance review system

نظام استعراض المراقبة

监视审查系统

Système d’examen des résultats de la surveillance

Система просмотра данных наблюдения

sistema de examen de datos de vigilancia

System zur Auswertung von Beobachtungsaufnahmen

監視レビューシステム

7.12. Unattended monitoring system (UMS)

نظام رصد آلي

无人值守监测系统

Système de surveillance automatique

Автономная система мониторинга (АСМ)

sistema de vigilancia automático (UMS)

System zur automatischen Überwachung

非立会モニタリングシステム（UMS）

7.13. Core discharge monitor (CDM)

جهاز رصد تعبئة وتفريغ قلب المفاعل

堆芯卸料监测器

Moniteur de déchargement du cœur (MDC)

Монитор выгрузки топлива из активной зоны (МВТ)

monitor de descarga del núcleo (CDM)

Überwachungsinstrument für eine Reaktor-Entladung

炉心（燃料）取り出しモニター（CDM）

7.14. Spent fuel bundle counter

عدَّاد حزم الوقود المستهلك

乏燃料棒束计数器

Compteur de grappes de combustible usé

Счетчик отработавших тепловыделяющих (топливных) сборок

contador de haces de combustible gastado

Zähler für abgebrannte Brennelementbündel

使用済燃料バンドル計数装置

7.15. Passive Gamma Emission Tomographic (PGET) System

نظام التصوير المقطعي السلبي بانبعاث أشعة غاما

无源 γ 发射断层照相系统

Système de tomographie à émission gamma passive

Система пассивной гамма-эмиссионной томографии (ПГЭТ)

sistema de tomografía por emisión pasiva de radiación gamma (sistema PGET)

Passives Gammastrahlen Emissions Tomographie System

パッシブガンマ断層撮影（PGET）システム

7.16. Reactor power monitor

جهاز رصد قدرة المفاعل

反应堆功率监测器

Enregistreur de la puissance d’un réacteur

Монитор мощности реактора

monitor de potencia de un reactor

Überwachungsinstrument für die Reaktorleistung

原子炉出力モニター

7.17. Thermohydraulic power measurement

قياس القدرة الهيدروليكية الحرارية

热工水力功率测量

Mesure de la puissance thermohydraulique

Термогидравлическое измерение мощности

medición de potencia termohidráulica

Thermohydraulische Leistungsmessung

熱水力測定

7.18. Criticality check

تحقُّق من الحرجية

临界检验

Contrôle de la criticité

Проверка на критичность

comprobación de la criticidad

Kritikalitätsprüfung

臨界確認

7.19. Radiation passage monitor

جهاز رصد حركة المواد النووية بالإشعاعات

通道辐射监测器

Détecteur de passage

Радиационный монитор перемещений

monitor de radiaciones en tránsito

Monitor zur Überwachung von Strahlung an Durchgängen

放射線通過モニター

7.20. Authentication measures

تدابير التوثيق

确证措施

Mesures d'authentification

Меры по обеспечению достоверности данных

medidas de autenticación

Maßnahmen zur Authentifizierung

認証手段

7.21. Encryption/decryption

تشفير/فك التشفير

加密/解密

Cryptage/décryptage

Шифрование/расшифровка

cifrado/descifrado

Verschlüsselung/Entschlüsselung

暗号化／復号化

7.22. Equipment state of health data

بيانات صلاحية المعدات للتشغيل

设备完好状况数据
Données sur l’état des équipements
Данные о работоспособности оборудования
datos sobre el estado de funcionamiento del equipo
Daten des Gerätezustandes
機器健全性データ

7.23. Safeguards equipment

معدات الضمانات

保障设备
Matériel des garanties
Оборудование для целей гарантий
equipo de salvaguardias
Ausrüstung für Sicherungsmaßnahmen
保障措置機器

7.24. Immobilization mechanism

آلية تثبيت

固定机制
Mécanisme d’immobilisation
Механизм иммобилизации
mecanismo de inmovilización
Mechanismus zur Immobilisierung
固定化機構

7.25. Remote data transmission (RDT)

نقل البيانات عن بُعد

远程数据传输
Télétransmission de données
Дистанционная передача данных (ДПД)
transmisión de datos a distancia (RDT)
Datenfernübertragung
遠隔データ伝送（RDT）

7.26. Equipment authorization

ترخيص المعدات

设备授权

Autorisation des équipements
Выдача разрешений на использование оборудования
autorización de equipo
Autorisierung der Ausrüstung
機器認証

7.27. Equipment validation

اعتماد المعدات

设备验证

Validation des équipements
Проверка оборудования
validación de equipo
Validierung der Ausrüstung
機器検証

7.28. Safeguards system with remote data transmission capability

نظام ضمانات مجهَّز بقدرة على نقل البيانات عن بُعد

具有远程数据传输能力的保障系统

Système de garanties avec capacité de télétransmission de données
Система гарантий с возможностью дистанционной передачи данных
sistema de salvaguardias con función de transmisión de datos a distancia
System der Sicherungsmaßnahmen mit der Fähigkeit zur Datenfernübertragung
遠隔データ伝送能力を備えた保障措置システム

7.29. Security critical component

مكوِّن حاسم من حيث الأمن

安保关键组成部分

Composant essentiel à la sécurité
Важный для безопасности компонент
componente crítico para la seguridad física
Sicherheitskritische Komponente
セキュリティ上重要な構成要素

7.30. Near Real Time System (NRTS)

نظام تحقُّق في وقت شبه حقيقي

近实时系统

Système en temps quasi réel (NRTS)

Система функционирования в режиме времени, близком к реальному (СВБР)
sistema en tiempo casi real (NRTS)
Echtzeitnahes System
近実時間システム（ニアリアルタイムシステム）（NRTS）

8. ENVIRONMENTAL SAMPLING

العينات البيئية

环境取样
ÉCHANTILLONNAGE DE L'ENVIRONNEMENT
ОТБОР ПРОБ ОКРУЖАЮЩЕЙ СРЕДЫ
MUESTREO AMBIENTAL
ENTNAHME VON UMWELT-PROBEN
環境試料の採取（環境サンプリング）

8.1. Environmental sampling (ES)

أخذ عينات بيئية

环境取样
Échantillonnage de l'environnement
Отбор проб окружающей среды (ОПОС)
muestreo ambiental (MA)
Entnahme von Umwelt-Proben
環境試料の採取（環境サンプリング）（ES）

8.2. Location specific environmental sampling

أخذ عينات بيئية من موقع محدَّد

针对场所的环境取样
Échantillonnage de l'environnement dans un emplacement précis
Отбор проб окружающей среды в конкретном месте нахождения
muestreo ambiental de un lugar específico
Ortspezifische Entnahme von Umwelt-Proben
特定の場所における環境試料の採取

8.3. Wide area environmental sampling

أخذ عينات بيئية من منطقة واسعة

大范围环境取样

Échantillonnage de l’environnement dans une vaste zone
Отбор проб окружающей среды на обширной территории
muestreo ambiental de grandes zonas
Großräumige Entnahme von Umwelt-Proben
広域的な環境試料の採取

8.4. Swipe sampling

أخذ عينات بالمسح

擦拭取样

Prélèvement d’échantillon par frottis
Отбор мазковых проб
muestreo por frotis
Wischprobe
拭き取り環境試料の採取

8.5. Point sample

أخذ عينات من نقطة منفردة

点样品

Échantillon ponctuel
Проба с одной точки
muestra puntual
Punktprobe
ポイント試料

8.6. Composite sample

عينة مركَّبة

混合样品

Échantillon composite
Проба с нескольких точек
muestra compuesta
Zusammengesetzte Probe (Sammelprobe)
コンポジット試料（複合試料）

8.7. Pre-inspection check sample

عينة مأخوذة قبل إجراء التفتيش

视察前检查样品

Échantillon de contrôle pré-inspection
Прединспекционная проба
muestra de control previa a la inspección
Kontrollprobe vor der Inspektion
査察前確認試料

8.8. Cross-contamination

انتقال التلوث

交叉污染
Contamination croisée
Перекрестное загрязнение
contaminación cruzada
Querkontamination
二次汚染（クロスコンタミネーション）

8.9. Baseline environmental signature

بيانات بيئية أساسية

基准环境特征
Signature environnementale de base
Реперный признак окружающей среды
huella ambiental de referencia
Grundlegende Umweltmerkmale
ベースライン環境試料特徴

8.10. Sampling team

فريق أخذ العيّنات

取样小组
Équipe d'échantillonnage
Группа по отбору проб
grupo de muestreo
Probenahmegruppe
サンプリングチーム

8.11. Environmental sampling kit

طقم أخذ العينات البيئية

环境取样盒

Trousse d’échantillonnage de l’environnement
Набор для отбора проб окружающей среды
juego (kit) de muestreo ambiental
Ausrüstung für Umwelt-Proben
環境試料採取キット（環境サンプリングキット）

8.12. Screening measurement

قياسات الفحص

筛选测量
Scrutation gamma
Предварительное измерение
medición de determinación
Voruntersuchungsmessung
選別測定

8.13. Bulk analysis

تحليل إجمالي

总体分析
Analyse globale
Анализ пробы в целом
análisis volumétrico
Analyse der Probenzusammensetzung
バルク分析

8.14. Particle analysis

تحليل جُسيمي

微粒分析
Analyse de particules
Анализ частиц
análisis de partículas
Teilchenanalyse
粒子分析（パーティクル分析）

8.15. Fission track analysis

تحليل بتعقب النويدات الانشطارية

裂变径迹分析

Analyse par traces de fission
Анализ треков деления
análisis por trazas de fisión
Spaltspuranalyse
フィッションｔラック分析

8.16. Scanning electron microscopy (SEM)

استجهار بطريقة المسح الإلكتروني

扫描电子显微镜

Microscopie électronique à balayage
Растровая электронная микроскопия (РЭМ)
microscopia electrónica de barrido (SEM)
Rasterelektronen-Mikroskopie
走查型電子顕微鏡法（SEM）

8.17. Secondary ion mass spectrometry (SIMS) (including large geometry SIMS (LG-SIMS))

قياس الطيف الكتلي للأيونات الثانوية (بما في ذلك قياس الطيف الكتلي الكبير النسق للأيونات الثانوية)

次级离子质谱测定法（包括大型几何次级离子质谱测定法）

Spectrométrie de masse à émission d'ions secondaires (SIMS) (y compris la spectrométrie de masse à émission d'ions secondaires à large géométrie)
Вторично-ионная масс-спектрометрия (ВИМС) (в том числе ВИМС с увеличенной геометрией (ВИМС-УГ))
espectrometría de masas de iones secundarios (SIMS) (incluida la espectrometría SIMS de grandes dimensiones (LG-SIMS))
Sekundärionen-Massenspektrometrie (einschließlich der großgeometrischen Sekundärionen-Massenspektrometrie)
二次イオン質量分析（SIMS）（大型SIMSを含む（LG-SIMS））

8.18. Material characterization

تحديد خصائص المواد

材料表征

Caractérisation des matières
Характеризация материалов
caracterización de material

Materialcharakterisierung
物質キャラクタリゼーション

8.19. Multi-collector inductively coupled plasma mass spectrometry (MC–ICP-MS)

قياس الطيف الكتلي البلازمي المقرون بالحث والمزوَّد بمجمِّعات متعددة
多接收器电感耦合等离子体质谱测定法
Spectrométrie de masse par plasma induit couplé à la multicollection
Мультиколлекторная масс-спектрометрия с индуктивно связанной плазмой (МК-МС-ИСП)
espectrometría de masas con plasma acoplado inductivamente con colector múltiple (MC-ICP-MS)
Multikollektor induktiv gekoppelte Plasmamassenspektrometrie
マルチコレクタ誘導結合プラズマ質量分析法（MC-ICP-MS）

8.20. Minor uranium isotopes

نظائر يورانيوم ثانوية
微量铀同位素
Isotopes mineurs de l'uranium
Незначительные изотопы урана
isótopos menores del uranio
Minore Uran-Isotope
マイナーウラン同位体

8.21. Environmental samples

عينات بيئية
环境样品
Échantillons de l'environnement
Пробы окружающей среды
muestras ambientales
Umweltproben
環境試料

9. STATISTICAL CONCEPTS AND TECHNIQUES FOR NUCLEAR MATERIAL VERIFICATION

المفاهيم والتقنيات الإحصائية المتعلقة بالتحقُّق من المواد النووية
核材料核实的统计学概念和技术

NOTIONS ET TECHNIQUES STATISTIQUES POUR LA VÉRIFICATION DES MATIÈRES NUCLÉAIRES
СТАТИСТИЧЕСКИЕ КОНЦЕПЦИИ И МЕТОДЫ ПРОВЕРКИ ЯДЕРНОГО МАТЕРИАЛА
TÉCNICAS Y CONCEPTOS ESTADÍSTICOS PARA LA VERIFICACIÓN DE MATERIAL NUCLEAR
STATISTISCHE KONZEPTE UND TECHNIKEN ZUR KERNMATERIALÜBERPRÜFUNG
核物質検認のための統計的概念及び技術

9.1. Material balance evaluation

تقييم حصر المواد

材料平衡评价

Évaluation du bilan matières

Оценка баланса материала

evaluación del balance de materiales

Materialbilanz-Auswertung

物質収支評価

9.2. Inspector’s estimate of MUF (IMUF)

تقدير المفتِّش للمواد غير المحصورة

视察员对不明材料量的估计

Estimation de la DI par l’inspecteur

Оценка НКМ инспектором (ИНКМ)

estimación del MNC hecha por el inspector (MNCI)

Inspektor’s MUF Schätzung

査察員によるMUFの推定（IMUF）

9.3. Operator–inspector difference

الفرق بين قياس الجهة المشغلة وقياس المفتش

营运者–视察员差额

Écart exploitant/inspecteur (EEI)

Расхождение данных оператора и инспектора

diferencia operador-inspector

Differenz zwischen Betreiber und Inspektor (D)

事業者－査察員間差異

9.4. D statistic

الفرق بين القيمة المعلنة من الجهة المشغلة والقيمة المقاسة من المفتش

D 统计
Statistique agrégée de la propagation des écarts exploitant/inspecteur
D статистика
estadística D
Differenz (D) Statistik
D統計量

9.5. MUF tuners

موالفات المواد غير المحصورة
不明材料量调整
Modification d'inventaire pouvant ajuster la matière non comptabilisée
Методы манипулирования с НКМ
parámetros de ajuste del MNC
MUF Tuner
MUFチューナー

9.6. Diversion into MUF

تحريف في المواد غير المحصورة
转入不明材料量
Détournement dans la DI
Переключение, связанное с НКМ
material desviado y declarado como MNC
Abzweigung in den MUF
MUFへの転用

9.7. Diversion into SRD

التحريف المؤدي لظهور فرق بين قياس الشاحن وقياس المستلم
转入发货方/收货方差额
Détournement dans l'EED
Переключение, связанное с РОП
material desviado y declarado como DRD
Abzweigung in die SRD
SRDへの転用

9.8. Diversion into D

التحريف المؤدي لظهور فرق بين المواد المعلن عن وجودها والمواد الموجودة فعلا
转入D
Détournement dans l'EEI

Переключение, связанное с расхождением данных оператора и инспектора (переключение в D)
desviación causante de discrepancia (D)
Abzweigung in den D-Wert
Dへの転用

9.9. Defect

خلل

缺损
Défaut
Дефект
defecto
Defekt
欠損

9.10. Sample size

حجم العيّنة

样品量
Taille de l'échantillon
Объем выборки
tamaño de la muestra
Stichprobenumfang oder -größe
サンプルサイズ

9.11. Measurement error

خطأ في القياس

测量误差
Erreur de mesure
Погрешность измерений
error de medición
Messfehler
測定誤差

9.12. Random error

خطأ عشوائي

随机误差
Erreur aléatoire
Случайная погрешность

error aleatorio
Zufälliger Fehler
偶然誤差

9.13. Systematic error

خطأ منتظم

系统误差
Erreur systématique
Систематическая погрешность
error sistemático
Systematischer Fehler
系統誤差

9.14. Residual bias

الانحراف المتبقّي

残余偏倚
Biais résiduel
Остаточное смещение
sesgo residual
Verbleibender systematischer Fehler (Restbias)
残留偏差

9.15. Error propagation

انتشار الخطأ

误差传递
Propagation des erreurs
Определение суммарной погрешности
propagación de errores
Fehlerfortpflanzung
誤差伝播

9.16. Limits of error

حدود الخطأ

误差限值
Limites d’erreur
Пределы погрешности
límites de error
Fehlergrenzen

誤差限界

9.17. Confidence limits

حدود الثقة

置信限

Limites de confiance

Доверительные пределы

límites de confianza

Konfidenzgrenzen

信頼限界

9.18. Outlier

قيمة متطرِّفة

离群值

Point aberrant

Выброс (при измерениях)

valor atípico

Ausreißer

外れ値（アウトライヤー）

9.19. Performance values

قيم الأداء

性能值

Indicateurs de performance

Значения, характеризующие качество измерений

valores históricos

Werte für Messunsicherheiten

実績値

9.20. Hypothesis test

اختبار الفرضية

假设检验

Test d'hypothèse

Проверка гипотезы

comprobación de la hipótesis

Hypothesentest

仮説検定

9.21. Statistically significant

ذو دلالة إحصائية

统计显著性

Statistiquement significatif

Статистически значимый

estadísticamente significativo

Statistisch signifikant

統計的有意

9.22. Type I error

خطأ من الطراز الأوَّل

第一类错误

Erreur du type I

Погрешность первого рода

error tipo I

Fehler I. Art

第I種の過誤

9.23. Type II error

خطأ من الطراز الثاني

第二类错误

Erreur du type II

Погрешность второго рода

error tipo II

Fehler II. Art

第II種の過誤

9.24. Power of a test

قوة الاختبار

检验的功效

Puissance d’un test

Эффективность проверки гипотезы

potencia de una prueba

Gütefunktion eines Tests

検出力

9.25. Attributes test

اختبار الخصائص

属性检验
Test par attributs
Атрибутивный тест
prueba de atributos
Test eines qualitativen Merkmals
アトリビュート（属性）検定

9.26. Variables test

اختبار المتغيرات

变量检验
Test par variables
Количественный тест
prueba de variables
Test eines quantitativen Merkmals
バリアブル（計量）検定

9.27. Critical region

منطقة حرجة

临界区域
Région critique
Критическая область
región crítica
Kritischer Bereich
棄却域

9.28. Selection probability

احتمالية الاختيار

选择概率
Probabilité de sélection
Вероятность выбора
probabilidad de selección
Auswahlwahrscheinlichkeit
選択確率

9.29. Identification probability

احتمالية تحديد العيب

识别概率
Probabilité d'identification

Вероятность идентификации
probabilidad de identificación
Identifikationswahrscheinlichkeit
識別可能性

9.30. Detection probability

احتمالية الكشف

探知概率
Probabilité de détection
Вероятность обнаружения
probabilidad de detección
Entdeckungswahrscheinlichkeit
探知（検知）確率

9.31. False alarm probability

احتمالية الإنذار الكاذب

误报警概率
Probabilité de fausse alerte
Вероятность ложного сигнала
probabilidad de falsa alarma
Fehlalarmwahrscheinlichkeit
誤警報確率

9.32. Verification level

مستوى التحقق

核查水平
Niveau de vérification
Проверочный уровень
nivel de verificación
Nachweisgrenze
検認レベル

9.33. Sampling plan

خطة أخذ العينات

取样计划
Plan d'échantillonnage
План формирования выборки
plan de muestreo

Stichprobenplan
サンプリング計画

9.34. Variable sampling in the attribute mode

عينات متغيرة في نمط الخاصية

属性模式中的变量取样

Sondage de variable qualitative
Выборка переменного объема по атрибутивному признаку
muestreo de variables en el modo de atributos
Variable Probenahme im Attributmodus
アトリビュート（属性）モードにおけるバリアブル（計量）サンプリング

9.35. Variable sampling in the variable mode

عينات متغيرة في النمط المتغير

可变模式中的变量取样

Sondage de variable quantitative
Выборка переменного объема по количественному признаку
muestreo de variables en el modo de variables
Variable Probenahme im variablen Modus
バリアブル（計量）モードにおけるバリアブル（計量）サンプリング

9.36. Relative standard deviation (RSD)

معامل التغيُّر

相对标准偏差

Coefficient de variation (CV)
Относительное стандартное отклонение (OCO)
desviación estándar relativa (RSD)
Relative Standardabweichung
相対標準偏差（RSD）

9.37. Measurement uncertainty

عدم التيقّن في القياس

测量不确定度

Incertitude des mesures
Неопределенность результата измерений
incertidumbre de medición

Messunsicherheit
測定の不確かさ

9.38. **Statistical sample**

عينة إحصائية

统计样品
Échantillon statistique
Статистическая выборка
muestra estadística
Statistische Stichprobe
統計サンプル

10. VISITS AND ACTIVITIES IN THE FIELD

الزيارات والأنشطة في الميدان

现场访问和活动
VISITES ET ACTIVITÉS SUR LE TERRAIN
ПОСЕЩЕНИЯ И ДЕЯТЕЛЬНОСТЬ НА МЕСТАХ
VISITAS Y ACTIVIDADES SOBRE EL TERRENO
BESUCHE UND AKTIVITÄTEN VOR ORT
訪問と現場活動

10.1. **Visit**

زيارة

访问
Visite
Посещение
visita
Besuch
訪問

10.2. **Design information verification (DIV)**

تحقُّق من المعلومات التصميمية

设计资料核实
Vérification des renseignements descriptifs (VRD)
Проверка информации о конструкции (ПИК)
verificación de la información sobre el diseño (VID)
Verifikation der grundlegenden technischen Merkmale
設計情報検認（DIV）

10.3. Inspection

تفتيـــش

视察
Inspection
Инспекция
inspección
Inspektion
査察

10.4. Initial inspection

تفتيش أولي

初始视察
Inspection initiale
Первоначальная инспекция
inspección inicial
Erst-Inspektion
冒頭査察

10.5. Ad hoc inspection

تفتيش حسب الاقتضاء

特别视察
Inspection ad hoc
Инспекции для специальных целей
inspección *ad hoc*
Ad hoc-Inspektion
特定査察

10.6. Routine inspection

تفتيش روتيني

例行视察
Inspection régulière
Обычная инспекция
inspección ordinaria
Routine-Inspektion
通常査察

10.7. Unannounced inspection

تفتيش مفاجئ

不通知的视察
Inspection inopinée
Необъявленная инспекция
inspección no anunciada
Nicht angekündigte Inspektion
無通告査察

10.8. Short notice inspection

تفتيش بإخطار عاجل

临时通知的视察
Inspection à court délai de préavis
Инспекция с краткосрочным уведомлением
inspección con breve preaviso
Inspektion mit kurzfristiger Vorankündigung
短期通告査察

10.9. Random inspection

تفتيش عشوائي

随机视察
Inspection aléatoire
Инспекция на случайной основе
inspección aleatoria
Zufällig ausgewählte Inspektion
ランダム査察

10.10. Short notice random inspection (SNRI)

تفتيش عشوائي بإخطار عاجل

临时通知的随机视察
Inspection aléatoire à court délai de préavis (IACP)
Инспекция на случайной основе с краткосрочным уведомлением (ИСКУ)
inspección aleatoria con breve preaviso (IABP)
Zufällig ausgewählte Inspektion mit kurzfristiger Vorankündigung
短期通告ランダム査察（SNRI）

10.11. Limited frequency unannounced access (LFUA)

معاينة مفاجئة محدودة التواتر

有限频度不通知的接触

Accès inopiné à fréquence limitée
Ограниченный по частоте необъявленный доступ (ОЧНД)
acceso no anunciado de frecuencia limitada (ANAFL)
In der Häufigkeit beschränkter, nicht angekündigter Zugang
頻度限定無通告立入（LFUA）

10.12. Simultaneous inspections

عمليات تفتيش متزامنة

同时视察
Inspections simultanées
Одновременные инспекции
inspecciones simultáneas
Gleichzeitige Inspektionen
同時査察

10.13. Continuous inspection

تفتيش مستمر

连续视察
Inspection en continu
Непрерывная инспекция
inspección continua
Kontinuierliche Inspektion
常時（常駐）査察

10.14. Special inspection

تفتيش خاص

专门视察
Inspection spéciale
Специальная инспекция
inspección especial
Sonderinspektion
特別査察

10.15. Access for inspection

معاينة لأغراض التفتيش

视察接触
Accès aux fins d’inspection
Доступ для инспектирования

acceso con fines de inspección
Zugang zu Inspektionszwecken
査察のためのアクセス（接近）

10.16. Scope of inspection

نطاق التفتيش

视察范围
Portée des inspections
Объем инспекции
alcance de la inspección
Umfang einer Inspektion
査察の範囲

10.17. Frequency of inspection

تواتُر التفتيش

视察频度
Fréquence des inspections
Частота инспекций
frecuencia de las inspecciones
Häufigkeit der Inspektionen
査察の頻度

10.18. Advance notice of inspections

إخطار مسبق بعمليات التفتيش

视察的预先通知
Préavis pour les inspections
Предварительное уведомление об инспекциях
aviso anticipado de las inspecciones
Vorankündigung von Inspektionen
査察の事前通告

10.19. Inspection activities

أنشطة التفتيش

视察活动
Activités d'inspection
Инспекционная деятельность
actividades de inspección
Inspektionstätigkeiten

査察活動

10.20. IAEA inspector

مفتش تابع للوكالة الدولية للطاقة الذرية

国际原子能机构视察员

Inspecteur de l'AIEA
Инспектор МАГАТЭ
inspector del OIEA
IAEO-Inspektor
IAEA査察員

10.21. Calendar-days in the field for verification (CDFVs)

أيام تقويمية ميدانية لأغراض التحقق

现场核查历日

Jours calendaires sur le terrain pour des activités de vérification (JCTV)
Календарные дни работы на местах в целях проверки (КДМП)
días civiles sobre el terreno con fines de verificación (DCTV)
Kalendertage der Verifikationstätigkeiten vor Ort
現場検認のための活動日数（CDFVs）

10.22. Person-day of inspection (PDI)

يوم عمل تفتيشي

视察人–日

Journée d'inspection
Человеко-день инспекций (ЧДИ)
día-persona de inspección (DPI)
Inspektions-Personentag
査察人日（PDI）

10.23. Person-year of inspection

سنة عمل تفتيشي

视察人–年

Année d'inspection
Человеко-год инспекций
año-persona de inspección
Inspektions-Personenjahr
査察人年

10.24. **Actual routine inspection effort (ARIE)**

جهد تفتيش روتيني فعلي

实际例行视察量

Activité réelle d’inspection régulière (ARIR)

Реальный объем обычной инспекционной деятельности (РОИД)

actividad real de inspección ordinaria (ARIO)

Inspektions-Personenjahr

通常査察実業務量（ARIE）

10.25. **Planned actual routine inspection effort (PLARIE)**

جهد تفتيش روتيني فعلي مخطَّط

计划的实际例行视察量

Activité réelle d’inspection régulière prévue (ARIRP)

Запланированный реальный объем обычной инспекционной деятельности (ЗРОИД)

actividad real de inspección ordinaria programada (ARIOP)

Geplanter tatsächlicher Routine-Inspektionsaufwand

計画通常査察実業務量（PLARIE）

10.26. **Maximum routine inspection effort (MRIE)**

أقصى جهد تفتيش روتيني

最大例行视察量

Activité maximale d’inspection régulière (AMIR)

Максимальный объем обычной инспекционной деятельности (МОИД)

actividad máxima de inspección ordinaria (AMIO)

Maximaler Routine-Inspektionsaufwand

最大通常査察業務量（MRIE）

10.27. **Complementary access**

معاينة تكميلية

补充接触

Accès complémentaire

Дополнительный доступ

acceso complementario

Erweiterter Zugang

補完的なアクセス

10.28. **Managed access**

معاينة محكومة

受管接触

Accès réglementé
Регулируемый доступ
acceso controlado
Geregelter Zugang
管理されたアクセス

10.29. Location

مكان

场所

Emplacement
Место нахождения
lugar
Ort
場所

10.30. Site

موقع

场址
Site
Площадка
emplazamiento
Standort
サイト

10.31. Advance notice of complementary access

إخطار مسبق بمعاينة تكميلية

补充接触的预先通知

Préavis d’accès complémentaire
Предварительное уведомление о дополнительном доступе
aviso anticipado de acceso complementario
Vorankündigung für erweiterten Zugang
補完的なアクセスの事前通告

10.32. Complementary access activities

أنشطة معاينة تكميلية

补充接触活动
Activités au titre de l’accès complémentaire
Деятельность в рамках дополнительного доступа
actividades de acceso complementario
Tätigkeiten während des erweiterten Zugangs
補完的なアクセスの活動

11. SAFEGUARDS INFORMATION AND EVALUATION

معلومات الضمانات وتقييم الضمانات

保障资料和评价

INFORMATIONS RELATIVES AUX GARANTIES ET ÉVALUATION DES GARANTIES
ИНФОРМАЦИЯ ОБ ОСУЩЕСТВЛЕНИИ ГАРАНТИЙ И ОЦЕНКА ГАРАНТИЙ
INFORMACIÓN Y EVALUACIÓN CON FINES DE SALVAGUARDIAS
AUF SICHERUNGSMAßNAHMEN BEZOGENE INFORMATION UND DEREN AUSWERTUNG
保障措置情報及び評価

11.1. Safeguards relevant information

معلومات ذات صلة بالضمانات

保障相关资料
Information pertinente pour les garanties
Информация, имеющая отношение к гарантиям
información de importancia para las salvaguardias
Relevante Informationen über Sicherungsmaßnahmen
保障措置関連情報

11.2. Initial report

تقرير أولي

初始报告
Rapport initial
Первоначальный отчет
informe inicial
Anfangsbericht
冒頭報告

11.3. Routine report

تقرير روتيني

例行报告

Rapport régulier

Обычный отчет

informe ordinario

Regelbericht

通常報告

11.4. Accounting report

تقرير الحصر

衡算报告

Rapport comptable

Учетный отчет

informe contable

Buchungsbericht

計量報告

11.5. Inventory change report (ICR)

تقرير التغيُّر في الرصيد

存量变化报告

Rapport sur les variations de stock (RVS)

Отчет об изменениях инвентарного количества (ОИИК)

informe de cambios en el inventario (ICR)

Bestandsänderungsbericht

在庫変動報告（ICR）

11.6. Concise notes

مذكرات مقتضبة

简要说明

Notes concises

Краткие справки

notas concisas

Kurzgefaßte Bemerkung

注釈

11.7. Material balance report (MBR)

تقرير حصر المواد

材料平衡报告
Rapport sur le bilan matières (RBM)
Материально-балансовый отчет (МБО)
informe de balance de materiales (MBR)
Materialbilanzbericht
物質収支報告（MBR）

11.8. Physical inventory listing (PIL)

قائمة الرصيد المادي

实物存量报表
Liste des articles du stock physique (PIL)
Список фактически наличного количества (СФНК)
lista del inventario físico (PIL)
Aufstellung des realen Material-Bestands
実在庫明細表（PIL）

11.9. Operating report

تقرير التشغيل

运行报告
Rapport sur les opérations
Эксплуатационный отчет
informe de operaciones
Betriebsbericht
操作報告

11.10. Special report

تقرير خاص

专门报告
Rapport spécial
Специальный отчет
informe especial
Besonderer Bericht
特別報告

11.11. Mailbox declaration

إعلان بالصندوق البريدي

邮箱申报

Déclaration par boîte à lettres
Заявление через «почтовый ящик»
declaración enviada a un buzón electrónico
Besonderer Bericht
メールボックス申告

11.12. Notification of transfers

إشعار بعمليات النقل

转让通知

Notification de transferts
Уведомление о передачах
notificación de traslados
Mitteilung über Lieferungen
移転の通告

11.13. Confirmation of transfers

تأكيد عمليات النقل

转让确认

Confirmation de transferts
Подтверждение передач
confirmación de traslados
Bestätigung von Lieferungen
移転の確認

11.14. Voluntary reports on nuclear material, specified equipment and non-nuclear material

تقارير طوعية عن مواد نووية ومعدات محددة ومواد غير نووية

关于核材料、规定设备和非核材料的自愿报告

Rapports volontaires sur les matières nucléaires et les équipements et matières non nucléaires spécifiés

Добровольные отчеты о ядерном материале, согласованном оборудовании и неядерном материале

notificaciones voluntarias sobre material nuclear, equipo especificado y material no nuclear

Freiwilliger Bericht über Nuklearmaterial, spezifizierte Ausrüstung und nicht-nukleares Material

核物質、特定機器及び非核物質に関する自発的報告

11.15. Declaration pursuant to an additional protocol

إعلان بموجب بروتوكول إضافي

按照附加议定书的申报

Déclaration en application d’un protocole additionnel

Заявление в связи с дополнительным протоколом

declaración presentada con arreglo a un protocolo adicional

Meldung gemäß Zusatzprotokoll

追加議定書に基づく申告

11.16. Initial AP declaration

إعلان أولي بموجب بروتوكول إضافي

初始附加议定书申报

Déclaration initiale au titre d’un PA

Первоначальное заявление в соответствии с ДП

declaración inicial con arreglo al PA

Erstmeldung gemäß AP

冒頭AP申告

11.17. Annual AP update declaration

إعلان استيفائي سنوي بموجب بروتوكول إضافي

年度附加议定书更新申报

Mise à jour annuelle au titre d’un PA

Годовое обновление заявления в соответствии с ДП

declaración anual de actualización con arreglo al PA

Jährliche aktualisierte Meldung gemäß AP

年次AP更新申告

11.18. Quarterly AP declaration

إعلان فصلي بموجب بروتوكول إضافي

季度附加议定书申报

Déclaration trimestrielle au titre d’un PA

Квартальное заявление в соответствии с ДП

declaración trimestral con arreglo al PA

Vierteljährliche Meldung gemäß AP

四半期AP申告

11.19. State Declarations Portal (SDP)

بوابة إلكترونية لإعلانات الدول

国家申报门户

Portail des déclarations des États (SDP)
Портал для передачи информации государствами (SDP)
Portal de Declaraciones de los Estados (SDP)
Portal für staatliche Meldungen
国別申告ポータル（SDP）

11.20. Protocol Reporter

البرنامج الحاسوبي Protocol Reporter

议定书报告软件
Protocol Reporter
Protocol Reporter
Protocol Reporter
Protocol Reporter
プロトコールレポーター

11.21. Open source information

معلومات من مصادر مفتوحة

公开来源的资料
Informations provenant de sources librement accessibles
Информация из открытых источников
información de fuentes de libre acceso
Information aus öffentlich zugänglichen Quellen
公開情報

11.22. Third party information

معلومات من أطراف ثالثة

第三方资料
Informations fournies par des tiers
Информация от третьих сторон
información obtenida de terceros
Informationen von Drittparteien
第三者情報

11.23. Incident and Trafficking Database (ITDB)

قاعدة بيانات الحادثات والاتجار غير المشروع

事件和贩卖数据库
Base de données sur les incidents et les cas de trafic (ITDB)
База данных по инцидентам и незаконному обороту (ITDB)

Base de Datos sobre Incidentes y Tráfico Ilícito (ITDB)
Datenbank über (illegale/n) Vorfälle und Handel
インシデント及び不正取引データベース（ITDB）

11.24. Safeguards implementation issue

قضية متصلة بتنفيذ الضمانات

保障执行问题

Question concernant l'application des garanties
Проблема осуществления гарантий
cuestión relativa a la aplicación de las salvaguardias
Problem bei der Umsetzung der Sicherungsmaßnahmen
保障措置実施上の課題

11.25. Discrepancy

تضارب

不符合

Écart
Расхождение
discrepancia
Diskrepanz
不一致

11.26. Anomaly

حالة شاذة

异常

Anomalie
Аномалия
anomalía
Anomalie
アノマリー

11.27. IAEA confidentiality regime

نظام السرية التابع للوكالة الدولية للطاقة الذرية

国际原子能机构保密制度

Régime de confidentialité de l'AIEA
Режим конфиденциальности в МАГАТЭ
régimen de confidencialidad del OIEA
IAEO-System zum Schutz vertraulicher Informationen

IAEA機密保護（保持）体制

11.28. State evaluation

تقييم على مستوى الدولة

国家评价
Évaluation au niveau de l’État
Оценка государства
evaluación a nivel de un Estado
Staatenspezifische Auswertung
国別評価

11.29. State Evaluation Group (SEG)

فريق التقييم الحكومي

国家评价小组
Groupe d’évaluation au niveau de l’État (GEE)
Группа оценки государства (ГОГ)
Grupo de Evaluación a nivel del Estado (GEE)
Gruppe für die Evaluierung eines Staates
国別評価グループ（SEG）

11.30. Safeguards effectiveness evaluation

تقييم فعالية الضمانات

保障有效性评价
Évaluation de l’efficacité des garanties
Оценка действенности гарантий
evaluación de la eficacia de las salvaguardias
Auswertung der Wirksamkeit von Sicherungsmaßnahmen
保障措置有効性評価

11.31. Safeguards State evaluation report

تقرير تقييم الضمانات على مستوى الدولة

国家保障评价报告
Rapport d’évaluation des garanties au niveau de l’État
Отчет об оценке гарантий в государстве
informe sobre las evaluaciones de salvaguardias a nivel de un Estado
Bericht über die staats-spezifische Auswertung von Sicherungsmaßnahmen
保障措置国別評価報告

11.32. Safeguards conclusions

استنتاجات الضمانات

保障结论

Conclusions relatives aux garanties

Заключения о применении гарантий

conclusiones de salvaguardias

Schlußfolgerungen aus Sicherungsmaßnahmen

保障措置結論

12. REPORTING ON SAFEGUARDS IMPLEMENTATION

تقديم التقارير عن تنفيذ الضمانات

报告保障执行情况

PRÉSENTATION DE RAPPORTS SUR L'APPLICATION DES GARANTIES

ОТЧЕТНОСТЬ ОБ ОСУЩЕСТВЛЕНИИ ГАРАНТИЙ

PRESENTACIÓN DE INFORMES SOBRE LA APLICACIÓN DE LAS SALVAGUARDIAS

BERICHTERSTATTUNG ÜBER DIE ANWENDUNG VON SICHERUNGSMAßNAHMEN

保障措置の実施に関する報告

12.1. Reporting on design information verification

تقديم التقارير عن التحقق من المعلومات التصميمية

报告设计资料核实情况

Présentation de rapports sur la vérification des renseignements descriptifs

Сообщение о проверке информации о конструкции

presentación de informes sobre la verificación de la información sobre el diseño

Berichterstattung über die Nachprüfung (Verifikation) von Anlagedaten

設計情報検認に関する報告

12.2. Statement on Inspection Results (90(a) Statement)

بيان عن نتائج التفتيش (البيان 90(أ))

视察结果说明（报表90(a)）

Déclaration sur les résultats des inspections [déclaration 90 a)]

Заявление о результатах инспекции (Заявление 90 a))

declaración sobre los resultados de las inspecciones (declaración 90 a))

Erklärung über die Ergebnisse der Inspektionen (Nachprüfungstätigkeiten)

査察結果に関する通報（90(a)通報）

12.3. Statement on Conclusions (90(b) Statement)

بيان عن الاستنتاجات (البيان 90(ب))

结论说明（报表90(b)）

Déclaration sur les conclusions [déclaration 90 b)]

Заявление о выводах (Заявление 90 b))

declaración sobre conclusiones (declaración 90 b))

Erklärung über die Schlußfolgerungen aus den Inspektionen (Nachprüfungstätigkeiten)

結論に関する通報（90(b)通報）

12.4. Book inventory statement

بيان الرصيد الدفتري

账面存量说明

Déclaration sur le stock comptable

Заявление о зарегистрированном инвентарном количестве

declaración sobre el inventario contable

Erklärung des Buchbestandes

帳簿在庫通報

12.5. Quarterly import communication

رسالة استيراد فصلية

季度进口通报

Communication trimestrielle sur les importations

Квартальное сообщение об импорте

comunicación de importaciones trimestral

Vierteljährliche Einfuhrmitteilung

四半期毎の輸入情報連絡

12.6. Statement on domestic and international transfers (semi-annual transit matching statement)

بيان عن عمليات النقل المحلية والدولية (بيان نصف سنوي عن مطابقة حالات العبور)

关于国内和国际转让的说明（半年度转运匹配说明）

Déclaration sur les transferts intérieurs et internationaux (déclaration semestrielle sur la mise en correspondance des expéditions et des arrivées)

Заявление о внутригосударственных и международных передачах (полугодовое заявление о согласованности данных о передачах)

declaración sobre traslados nacionales e internacionales (declaración semestral de comprobación de la correspondencia de traslados)
Erklärung über inländische und internationale Transfers
国内及び国際移転に関する通報（半期移転照合通報）

12.7. Statement of timeliness in reporting

بيان عن التأخير في التبليغ
提出报告的及时性说明
Déclaration sur les délais de présentation des rapports
Заявление о своевременности представления отчетности
declaración sobre la puntualidad en la presentación de los informes
Erklärung über die Rechtzeitigkeit der Berichterstattung
報告の適時性に関する通報

12.8. Reporting on inspections under an item-specific safeguards agreement

تقديم تقرير عن عمليات التفتيش بموجب اتفاق ضمانات يخص مفردات بعينها
根据特定物项保障协定的视察结果报告
Présentation de rapports sur les inspections en vertu d'un accord de garanties relatifs à des éléments particuliers
Сообщение об инспекциях в рамках соглашения о гарантиях в отношении конкретных предметов
informes sobre las inspecciones realizadas con arreglo a un acuerdo de salvaguardias específico para partidas
Berichterstattung über Inspektionen im Rahmen eines gegenstandspezifischen Sicherungsübereinkommens
対象物特定保障措置協定に基づく査察に関する報告

12.9. Statements under an AP

بيانات بموجب بروتوكول إضافي
根据附加议定书所作的说明
Déclarations en vertu d'un PA
Заявления в соответствии с ДП
declaraciones con arreglo a un PA
Erklärungen gemäß Zusatzprotokoll
追加議定書に基づく通報

12.10. Safeguards Implementation Report (SIR)

تقرير تنفيذ الضمانات
保障执行情况报告

Rapport sur l’application des garanties (SIR)
Доклад об осуществлении гарантий (ДОГ)
Informe sobre la Aplicación de las Salvaguardias (IAS)
Bericht über die Durchführung von Sicherungsmaßnahmen
保障措置実施報告書（SIR）

12.11. IAEA Annual Report

التقرير السنوي للوكالة الدولية للطاقة الذرية
国际原子能机构年度报告
Rapport annuel de l’AIEA
Годовой доклад МАГАТЭ
Informe Anual del OIEA
IAEO-Jahresbericht
IAEA年次報告書

12.12. Director General’s report on Strengthening the Effectiveness and Improving the Efficiency of Agency Safeguards

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关于加强国际原子能机构保障的有效性和提高其效率的总干事的报告
Rapport du Directeur général sur le renforcement de l’efficacité et l’amélioration de l’efficience des garanties de l’Agence
Доклад Генерального директора о повышении действенности и эффективности гарантий Агентства
informe del Director General sobre fortalecimiento de la eficacia y aumento de la eficiencia de las salvaguardias del Organismo
Bericht des Generaldirektors über die Stärkung der Effektivität und Verbesserung der Effizienz von IAEO-Sicherungsmaßnahmen
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السلطات والمسؤوليات والدعم والخدمات على الصعيدين الحكومي والإقليمي
国家和地区当局、责任、支持和服务
AUTORITÉS NATIONALES ET RÉGIONALES, RESPONSABILITÉS, APPUI ET SERVICES
ГОСУДАРСТВЕННЫЕ И РЕГИОНАЛЬНЫЕ КОМПЕТЕНТНЫЕ ОРГАНЫ, ОБЯЗАННОСТИ, ПОДДЕРЖКА И УСЛУГИ

AUTORIDADES, RESPONSABILIDADES, APOYO Y SERVICIOS ESTATALES Y REGIONALES

STAATLICHE UND REGIONALE BEHÖRDEN, VERANTWORTLICHKEITEN, UNTERSTÜTZUNG UND DIENSTLEISTUNGEN

国及び地域当局の責任及び支援並びにサービス

13.1. State (or regional) system of accounting for and control of nuclear material (SSAC/RSAC)

نظام حكومي (أو إقليمي) لحصر ومراقبة المواد النووية

国家（或地区）核材料衡算和控制系统（国家核材料衡控系统/地区核材料衡控系统）

Système national (ou régional) de comptabilité et de contrôle des matières nucléaires (SNCC/SRCC)

Государственная (или региональная) система учета и контроля ядерного материала (ГСУК/РСУК)

sistema nacional (o regional) de contabilidad y control de material nuclear (SNCC/SRCC)

Staatliches (oder regionales) System für Buchführung und Kontrolle von Kernmaterial

国内（または地域）核物質計量管理制度（SSAC／RSAC）

13.2. State or regional authority responsible for safeguards implementation (SRA)

سلطة حكومية أو إقليمية مسؤولة عن تنفيذ الضمانات

负责保障执行的国家当局或地区当局

Autorité nationale ou régionale chargée de l’application des garanties (ANR)

Государственный или региональный компетентный орган, ответственный за осуществление гарантий (ГРКО)

autoridad nacional o regional encargada de la aplicación de las salvaguardias (ANR)

Staatliche oder regionale Behörde verantwortlich für die Durchführung von Sicherungsmaßnahmen

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بنية أساسية للضمانات

保障基础结构

Infrastructure des garanties

Инфраструктура гарантий
infraestructura de salvaguardias
Infrastruktur für Sicherungsmaßnahmen
保障措置基盤（保障措置インフラ）

13.4. Safeguards regulatory infrastructure

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保障监管基础结构
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Инфраструктура регулирования гарантий
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保障措置規制基盤（保障措置規制インフラ）

13.5. IAEA Safeguards and SSAC Advisory Service (ISSAS)

الخدمة الاستشارية التابعة للوكالة والمعنية بالضمانات والنظم الحكومية لحصر ومراقبة المواد النووية

国际原子能机构保障与国家核材料衡控系统咨询服务
Service consultatif de l'AIEA sur les garanties et les systèmes nationaux de comptabilité et de contrôle des matières nucléaires
Консультативная служба МАГАТЭ по гарантиям и ГСУК (ИССАС)
Servicio de Asesoramiento del OIEA sobre Salvaguardias y SNCC (ISSAS)
Beratungsleistung zu IAEO-Sicherungsmaßnahmen und SSAC
IAEA保障措置及びSSAC諮問サービス（ISSAS）

13.6. Member State Support Programme (MSSP)

برنامج الدعم الخاص بالدول الأعضاء

成员国支助计划
Programme d'appui d'États Membres (PAEM)
Программа поддержки со стороны государств-членов (ППГЧ)
programa de apoyo de los Estados Miembros (PAEM)
Unterstützungsprogramm eines Mitgliedstaates
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13.7. Support Programme Information and Communication System (SPRICS)

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Système d’information et de communication sur les programmes d’appui (SPRICS)

Информационно-коммуникационная система программ поддержки (ИКСПП)

Sistema de Comunicación e Información de los Programas de Apoyo (SPRICS)

Informations- und Kommunikationssystem für Unterstützungsprogramme

支援計画情報及びコミュニケーションシステム（SPRICS）

13.8. Research and Development Plan

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研究与发展计划

Plan de recherche-développement

План научно-исследовательских и опытно-конструкторских работ

Plan de investigación y desarrollo

Forschungs- und Entwicklungsplan

研究開発計画

13.9. Enhancing Capabilities for Nuclear Verification: Resource Mobilization Priorities (RMP)

تعزيز القدرات للتحقق النووي: أولويات حشد الموارد

加强核核查能力：资源调动的优先事项

Renforcement des capacités dans le domaine de la vérification nucléaire : priorités en matière de mobilisation des ressources

Развитие потенциала ядерной проверки: приоритеты в области мобилизации ресурсов (ПМР)

Mejora de las capacidades de verificación nuclear: Prioridades para la movilización de recursos (RMP)

Verbesserung der Fähigkeiten zur nuklearen Verifikation: Prioritäten der Ressourcenmobilisierung

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13.10. Development and Implementation Support (D&IS) Programme for Nuclear Verification

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核核查的发展和实施支助计划

Programme de développement et d’appui à la mise en œuvre pour la vérification nucléaire

Программа поддержки опытно-конструкторских и внедренческих работ для целей ядерной проверки

Programa de apoyo al desarrollo y la aplicación de la verificación nuclear
Programm zur Unterstützung der Entwicklung und Durchführung der nuklearen Verifikation
核物質検認のための開発及び実施支援（D&IS）計画

13.11. Integrated Nuclear Infrastructure Review (INIR)

الاستعراض المتكامل للبنية الأساسية النووية
综合核基础结构评审
Examen intégré de l'infrastructure nucléaire (INIR)
Комплексная оценка ядерной инфраструктуры (ИНИР)
Examen Integrado de la Infraestructura Nuclear (INIR)
Integrierte Überprüfung der nuklearen Infrastruktur
統合原子力基盤レビュー（INIR）

13.12. Nuclear Power Support Group and Integrated Work Plan

فريق دعم القوى النووية وخطة العمل المتكاملة
核电支助组和综合工作计划
Groupe d'appui à l'énergie d'origine nucléaire et plan de travail intégré
Группа содействия развитию ядерной энергетики и комплексный план работы
Grupo de Apoyo a la Energía Nucleoeléctrica y Plan de Trabajo Integrado
Gruppe zur Unterstützung der Kernenergie und integrierter Arbeitsplan
原子力支援グループ及び統合業務計画

13.13. Standing Advisory Group on Safeguards Implementation (SAGSI)

الفريق الاستشاري الدائم المعني بتنفيذ الضمانات
保障执行常设咨询组（保障咨询组）
Groupe consultatif permanent sur l'application des garanties (SAGSI)
Постоянная консультативная группа по осуществлению гарантий (САГСИ)
Grupo Asesor Permanente sobre Aplicación de Salvaguardias (SAGSI)
Ständige beratende Gruppe für die Durchführung der Sicherungsmaßnahmen
IAEA保障措置実施諮問委員会

13.14 Safeguards by design

إدراج الضمانات في التصميم
设计中纳入保障

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13.15. Safeguards Traineeship Programme

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Программа стажировок в области гарантий
Programa de Capacitación en Salvaguardias
Traineeprogramm für Sicherungsmaßnahmen
保障措置研修プログラム

13.16. Brazilian–Argentine Agency for Accounting and Control of Nuclear Materials (ABACC)

الهيئة البرازيلية-الأرجنتينية لحصر ومراقبة المواد النووية

巴西-阿根廷核材料衡算和控制机构（巴阿核材料衡控机构）

Agence brasilo-argentine de comptabilité et de contrôle des matières nucléaires (ABACC)
Бразильско-аргентинское агентство по учету и контролю ядерных материалов (АБАКК)
Agencia Brasileño-Argentina de Contabilidad y Control de Materiales Nucleares (ABACC)
Brasilianisch-Argentinische Agentur für Buchführung und Kontrolle von Kernmaterial
核物質計量管理のためのブラジルーアルゼンチン機関（ABACC）

13.17. European Atomic Energy Community (Euratom)

الجماعة الأوروبية للطاقة الذرية (اليوراتوم)

欧洲原子能联营（欧原联）

Communauté européenne de l’énergie atomique (Euratom)
Европейское сообщество по атомной энергии (Евратом)
Comunidad Europea de la Energía Atómica (Euratom)
Europäische Atomgemeinschaft (Euratom)
欧州原子力委員会（Euratom）

13.18. New partnership approach (NPA)

نهج الشراكة الجديدة

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Новый принцип партнерства (НПП)
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13.19. Side-letter States

دول الرسالة الجانبية

补充协议国家

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13.20 Safeguards guidance in the IAEA Services Series

إرشادات الضمانات في سلسلة خدمات الوكالة

国际原子能机构《服务丛书》保障导则

Documents d’orientation dans le domaine des garanties publiés dans la collection Services de l’AIEA
Руководящие материалы по гарантиям в Серии услуг МАГАТЭ
orientaciones de salvaguardias en la *Colección de Servicios del OIEA*
Leitfaden für die IAEO-Serviceserie über Sicherungsmaßnahmen
IAEAサービスシリーズによる保障措置ガイダンス

ABBREVIATIONS AND ACRONYMS

ABACC	Brazilian–Argentine Agency for Accounting and Control of Nuclear Materials
AIP	annual implementation plan
AP	additional protocol
ARIE	actual routine inspection effort
ATPM	advanced thermohydraulic power monitor
AWCC	active well coincidence counter
BI	book inventory
C/S	containment and surveillance
CDM	core discharge monitor
CNIP	country nuclear infrastructure profile
CSA	comprehensive safeguards agreement
DA	destructive analysis
DIE	design information examination
DIQ	design information questionnaire
DIV	design information verification
EDXRF	energy dispersive X ray fluorescence
EEL	essential equipment list
ERML	Equipment Radiation Monitoring Laboratory (IAEA)
ES	environmental sampling
FF	fresh fuel
FSV	flow sheet verification
GSMS	gas source mass spectrometry
HEU	high enriched uranium
HLNCC	high level neutron coincidence counter
HPGe	high purity germanium
ICP-MS	inductively coupled plasma mass spectrometry
ICR	inventory change report
IDMS	isotope dilution mass spectrometry
IIL	itemized inventory listing
IIV	interim inventory verification
IMUF	inspector's estimate of material unaccounted for
INIR	Integrated Nuclear Infrastructure Review (IAEA)
ISA	International standards of accountancy
ISOCS	in situ object counting system
ISSAS	IAEA Safeguards and SSAC Advisory Service
ITDB	Incident and Trafficking Database (IAEA)
ITV	international target value

IWP	integrated work plan
JUA	joint use arrangement
JUE	joint use equipment
KMP	key measurement point
LEU	low enriched uranium
LFUA	limited frequency unannounced access
LG-SIMS	large geometry secondary ion mass spectrometry
LIBS	laser induced breakdown spectroscopy
LII	list of inventory items
LOF	location outside facilities
MBA	material balance area
MBP	material balance period
MBR	material balance report
MDC	material description code
MOX	mixed oxide
MRIE	maximum routine inspection effort
MSSP	Member State Support Programme (IAEA)
MUF	material unaccounted for
NDA	non-destructive assay
NNWS	non-nuclear-weapon State
NPA	new partnership approach
NPSG	Nuclear Power Support Group
NPT	Treaty on the Non-Proliferation of Nuclear Weapons
NRTA	near real time accountancy
NRTS	near real time system
NSG	Nuclear Suppliers Group
NWFZ	nuclear-weapon-free zone
NWS	nuclear-weapon State
PCAS	plutonium canister assay system
PDI	person-day of inspection
PGET System	Passive Gamma Emission Tomographic System
PIL	physical inventory listing
PIV	physical inventory verification
PLARIE	planned actual routine inspection effort
PUSP	Pu(VI) spectrophotometry
RDT	remote data transmission
RSAC	regional system of accounting for and control of nuclear material
RSD	relative standard deviation
SDP	State Declarations Portal
SEG	State Evaluation Group

SEM	scanning electron microscopy
SF	spent fuel
SIMS	secondary ion mass spectrometry
SIR	Safeguards Implementation Report (IAEA)
SLA	State-level safeguards approach
SLC	State-level concept
SNRI	short notice random inspection
SQ	significant quantity
SQP	small quantities protocol
SRA	State or regional authority responsible for safeguards implementation
SRD	shipper/receiver difference
SSAC	State system of accounting for and control of nuclear material
SSF	State-specific factor
STA	safeguards transfer agreement
TIMS	thermal ionization mass spectrometry
UMS	unattended monitoring system
VOA	voluntary offer agreement
VRS	voluntary reporting scheme
WDXRF	wavelength dispersive X ray fluorescence
XRF	X ray fluorescence

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